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The Engineer

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PUBLIC NOTICES

The High Commissioner for India is prepared to receive TENDERS for the SUPPLY of—
ENGINE TURNTABLES, Motor-driven, 70ft. diameter.
Forms of Tender may be obtained from the Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Friday, the 25th August, 1922.
T. RYAN,
Director-General.
8964

Royal Navy.
APPLICATIONS are INVITED for APPOINTMENTS as SCHOOLMASTER CANDIDATES.
Applicants must be between 21 and 30 years of age and medically fit.
They should have had Teaching Experience, or be qualified for Teaching Mathematics and Physics in Technical or Secondary Schools.
The following scale of pay has been approved :—

	A year.
Schoolmaster Candidate (for 6 months)..	£219
Probationary Schoolmaster (for 6 months)	£228
Schoolmaster (on confirmation, one year from entry)	£237

and thence by annual increments of £9 2s. 6d. a year to £456 a year.
Schoolmasters when confirmed have the rank of Warrant Officer, and are promoted to Commissioned Officer from Warrant Rank after 15 years' Service.
Special promotion to Senior Master is made by selection with minimum qualifying service of 8 years. Senior Masters are Commissioned Officers from Warrant Rank, and receive pay on the Schoolmasters' Scale, with an addition of £54 15s. a year.
Promotion to Headmaster, with rank of Lieutenant, is also by selection; rate of pay from £511 to £657 a year.
One per cent. of the Schoolmaster Branch may also be promoted to the rank of Commander, with pay from £730 to £949 a year.
Further particulars may be obtained from the ADVISER ON EDUCATION, Admiralty, Whitehall, S.W. 1. 8962

UNIVERSITY OF LONDON.
King's College.
FACULTY OF ENGINEERING.
Complete COURSES of STUDY, extending over either three or four years, are arranged in
CIVIL, MECHANICAL AND ELECTRICAL ENGINEERING.
for the Engineering Degrees of the University of London and for the Diploma and Certificate of the College.
The four years' course provides, in addition to the academic training, opportunity for practical training in "works."
HEADS OF DEPARTMENTS.
Professor G. COOK, D.Sc., A.M. Inst. C.E., A.M.I. Mech. E., Mechanical Engineering.
Professor A. H. JAMESON, M.Sc., M. Inst. C.E., Civil Engineering.
Professor E. WILSON, M. Inst. C.E., M.I.E.E. (Dean), Electrical Engineering.
Professor S. A. F. WHITE, M.A. } Mathematics.
Professor G. B. JEFFERY, M.A., D.Sc. }
Professor SAMUEL SMILES, O.B.E., D.Sc., F.I.C., F.R.S. } Chemistry.
Professor A. J. ALLMAND, M.C., D.Sc., F.I.C. }
Professor O. W. RICHARDSON, D.Sc., F.R.S., Physics.
Professor W. T. GORDON, D.Sc., F.R.S.E., Geology.
Considerable extensions have been made in the Engineering Department. These include a large additional drawing-office, lecture room and laboratory for Hydraulics and Strength of Materials in the Civil and Mechanical Departments; and research rooms, including Wireless Telegraphy, in the Electrical Engineering Department. Large additions have been made to the equipment of the laboratories in the three Departments for purposes of teaching and research.
There is a College Hostel and a large Athletic Ground.
For full information apply to the SECRETARY, King's College, Strand, W.C. 2. 8860

University of Birmingham.
DEPARTMENT OF METALLURGY.
PROFESSOR: THOMAS TURNER, M.Sc., A.R.S.M., F.I.C.
LECTURERS AND DEMONSTRATORS: T. G. BAMFORD, M.Sc.; HAROLD HARRIS, B.Sc.; T. H. TURNER, B.Sc.
The Course of Study covers three years, and leads to the Degree of B.Sc. in Metallurgy. There are separate Courses for Metallurgists and Metallurgical Chemists. Special attention is devoted to Iron and Steel, Copper, Brass, and Local Industries, and to preparation for Colonial and Foreign Posts.
Research and other Scholarships.
For particulars apply to the REGISTRAR. 8057

County Borough of East Ham
EDUCATION COMMITTEE.
EAST HAM TECHNICAL COLLEGE.
EVENING CLASSES.
Principal: W. H. BARKER, B.Sc., F.C.S.
APPLICATIONS are INVITED for the following TEACHING POSTS :—
1. METAL WORK and ENGINEERING PRACTICE (Monday, Tuesday and Friday evenings, 7-9.30 o'clock).
2. PRACTICAL MATHEMATICS (Monday evening, 7.30-9.30 o'clock).
A form of application, together with the conditions of appointment and scale of salaries, may be obtained from the undersigned on receipt of a stamped addressed envelope.
(Signed) F. R. THOMPSON,
Secretary.
28th July, 1922.
Education Office,
Town Hall, East Ham, E. 6. 8973

PUBLICATIONS.
WANTED, BOUND VOLUMES of "THE ENGINEER" from July, 1914, to June, 1919.—Address, stating lowest price, P1000, The Engineer Office. P1000 1

PUBLIC NOTICES

Birkenhead Union.
The Guardians of the Birkenhead Union invite TENDERS for the SUPPLY and FIXING of INTERNAL FLUES for a LANCASHIRE BOILER at the Union Institution, Derby-road, Birkenhead.
Specification of the work required to be done may be obtained from the undersigned, and Tenders must reach me in sealed envelopes on or before Saturday, the 19th August, 1922, endorsed "Tender for Lancashire Boiler."
The contractor in carrying out the contract shall pay the rate of wages and observe the hours of labour recognised and agreed upon between the trades unions and the employers in the locality.
The Guardians do not bind themselves to accept the lowest or any Tender.
The Tender of any person who directly or indirectly canvasses the Guardians will not be accepted.
By Order,
S. R. CARTER,
Clerk to the Guardians.
Poor Law Offices,
Conway-street, Birkenhead,
26th July, 1922. 8980

Borough of Richmond, Surrey.
The Council are prepared to receive TENDERS for—
CONTRACT No. 1.—The SUPPLY, ERECTING and SETTING TO WORK at the Waterlane Pumping Station of TWO STEAM PUMPING ENGINES.
CONTRACT No. 2.—The SUPPLY of ONE ELECTRICALLY DRIVEN CENTRIFUGAL BOOSTER PUMP, for the high level district supply.
Conditions and form of Tender may be obtained on application to Mr. H. Will. Apted, Assoc. M. Inst. C.E., Water Engineer, Waterworks, Richmond (Surrey), upon payment of a deposit of One Guinea, which will be returned upon receipt of a bona fide Tender.
Tenders must be addressed to the undersigned, endorsed "Tender No. 1" or "No. 2," so as to be received by him not later than September 20th, 1922.
The Council do not undertake to accept the lowest or any Tender.
HENRY SAGAR,
Town Clerk.
Town Hall,
Richmond, Surrey. 8970

Metropolitan Borough of STEPNEY
ELECTRICITY SUPPLY.
PLANT FOR SALE.
The above-named Council have FOR DISPOSAL the following PLANT :—
ONE 1000-Kilowatt 180 lb. pressure, 1500 r.p.m. Parsons TURBINE, coupled to Two 500-kilowatt Direct-current GENERATORS, 250 volts, each fitted with three-phase alternating-current Slip Rings, and complete with Contraflo Condenser, Motor-driven Circulating Water Pump and Spares, including Spare Armature for Generators.
ONE 1500-kilowatt 180 lb. pressure, 1500 r.p.m. Parsons TURBINE, coupled to 1750-kilovolt-ampere, 6600 volts, 50 cycles three-phase ALTERNATOR, with Exciter, together with Contraflo Condenser and Motor-driven Circulating Water Pump and Edwards Air and Condensate Pump.
ONE TURBO-ALTERNATOR, similar to the above, but with Willans and Robinson Reaction Turbine.
The plant can be inspected at any time and by arrangement can be seen running. Further particulars can be obtained on application to the undersigned.
The plant is offered in its present condition, and without guarantee, and offers will be considered for any one of, or all of, the above plants.
The Council do not bind themselves to accept the highest or any Tender.
WM. C. P. TAPPER,
Engineer and Manager.
27, Osborn-street,
Whitechapel, E. 1,
1st August, 1922. 8991

PUBLIC NOTICES

East Indian Railway.
The Directors are prepared to receive up to Eleven o'clock a.m. on Wednesday, the 30th August instant, TENDERS for the SUPPLY of—
93 DECK SPANS of 1006ft. in the clear.
Copies of the specification can be obtained at the Company's Offices on payment of £1 1s. each. This fee will not be returned.
G. E. LILLIE,
Secretary.
73-76, King William-street,
London, E.C. 4,
1st August, 1922. 8995

Romford Rural District Council
RIVERSIDE SEWERAGE.
CONTRACT No. 3. OUTFALL WORKS.
The above Council are prepared to receive TENDERS for the CONSTRUCTION of about 1800ft. of 3ft. diameter SEWER, RAILWAY CROSSING, JUNCTION CHAMBER, SCREENING WELL, PUMP WELL, ENGINE-HOUSE, WORKSHOP, OFFICES, EJECTOR-HOUSE, SLUDGE TANK, DETRITUS TANK, SEDIMENTATION TANKS, CHANNELS, FILTERS and other works, on a site adjoining Rainham Creek, in the Parish of Hornchurch.
The drawings, specification and bill of quantities can be inspected at the office of the Consulting Engineer, Mr. William Fairley, M. Inst. C.E., Parliament Mansions, Westminster, S.W. 1.
A limited number of the bill of quantities are available, and will be issued to approved contractors, on deposit of crossed cheque for £5, made payable to the Council, which deposit will be returned on receipt of bona fide Tender.
Copies of the drawings, specification and quantities may also be inspected at the office of Mr. W. J. Grant, Surveyor, Council Offices, Romford.
Sealed Tenders on form supplied to be lodged with the undersigned on or before Monday, the 21st August, 1922.
The Council do not bind themselves to accept the lowest or any Tender.
T. W. A. GREENHALGH,
Clerk to the Council.
Council Offices, Romford,
25th July, 1922. 8983

The Assam-Bengal Railway COMPANY, Limited, is prepared to receive TENDERS for—
STRUCTURAL STEEL WORK, GALVANISED WORK, &c., for Workshops.
Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged for the specification, which cannot under any circumstances be returned.
Drawings may be had at the cost of the tenderer by application to Messrs. Hodges Bennett and Co., Limited, 78, Queen Victoria-street, E.C. 4.
Tenders must be delivered at the Company's Offices not later than Noon on Wednesday, the 23rd August, 1922.
The Directors do not bind themselves to accept the lowest or any Tender.
By order of the Board,
OSWALD I. MILNE,
Secretary.
1st August, 1922. 8981

SITUATIONS OPEN
APPLICANTS who Replied to Advertisement Box 8871 for London Representative are THANKED and informed the POSITION IS NOW FILLED. 8987 A

WANTED, EFFICIENT MAN to TAKE CHARGE of TOOL ROOM; must be well experienced in the Production of Jigs, Tools and Fixtures and up-to-date methods of Hardening High-speed, Tool and Die Steels.—Apply, stating experience and salary required, to JOSEPH RHODES and SONS, Ltd., Grove Ironworks, Wakefield. 8958 A

PUBLIC NOTICES
PATENTS AND DESIGNS ACTS, 1907 and 1919
WIRE STITCHING OR STAPLING MACHINES.
The Proprietors of British Letters Patent No. 112,910 are prepared to SELL the PATENT or to LICENSE BRITISH MANUFACTURERS to work thereunder. It comprises an improved differential motion device for operating the bender bar and the mechanism for driving the staples through the work and clinching their legs.
Address, B. W. and T.,
111/112, Hatton-garden,
8993 London, E.C. 1.

Calcutta Improvement Trust.
A TEMPORARY ASSISTANT ENGINEER is REQUIRED to SUPERVISE the CONSTRUCTION of a THREE-HINGED REINFORCED CONCRETE ARCH BRIDGE of 128ft. span in the North of Calcutta.
Candidates must have had several years' practical experience in the Construction of Arch Bridges or similar important works in Reinforced Concrete. Salary Rs. 1000/- (one thousand) per mensem, with a motor car allowance of Rs. 100/- (one hundred) per mensem, and a free passage to and from Calcutta. Appointment for two years, subject to six months' notice on either side. Applications will be received up to the 31st August, 1922, in England, by C. H. Bompas, Esq., C.S.I., I.C.S., Mayfield, Seaton, Devon, and in India by the Chief Engineer, Calcutta Improvement Trust, 5, Clive-street, Calcutta.
T. EMERSON,
Chairman.
Calcutta,
5th July, 1922. P5839

SITUATIONS OPEN (continued)
WANTED, ERECTING ENGINEER for Large Chemical Plant; must be first-class Draughtsman and capable of assuming Entire Responsibility for Installation of Boilers, Foundations, Buildings and Plant. Splendid opportunity for a thoroughly experienced engineer. State full details of experience, age, salary expected, married or single, and when at liberty.—X. 1525, care of Willings, 33, Knightsbridge, S.W. 1. 8982 A

WANTED, PRACTICAL RATE FIXER for Steel Foundry in Sheffield, with a heavy and general class of work. Previous experience absolutely essential. Applicants should stage age and give full particulars of training and experience; also salary required and earliest date disengaged.—Write, K 75, Sheffield Telegraph, Sheffield. 8979 A

CAPABLE CONSTRUCTIONAL STEEL WORK DRAUGHTSMAN for Architect's Office, Liverpool district; age 25-35. State age, experience and salary required.—Address, 8990, The Engineer Office. 8990 A

CIVIL MUNICIPAL ENGINEER REQUIRED for City in North China; appointment on 3 years' agreement at salary of 700 taels per month, with passage out and back.—Applications by letter only, together with copies of testimonials, &c., to "C. A.," c.o. J. W. Vickers and Co., Ltd., 5, Nicholas-lane, E.C. 4. 9006 A

DEPARTMENTAL MANAGER REQUIRED by old-established firm in North Midlands, manufacturing Gas Fittings, Meters, &c.; must be thoroughly familiar with the trade and up-to-date methods of production.—Write, with particulars of age, experience and salary required, to 8999, The Engineer Office. 8999 A

ENGINEER.—WANTED by a London Engineering Concern, with works in the provinces, a competent ENGINEER, with first-class experience in the Design and Manufacture of all types of modern Condensing Plant. Applicants must possess first-rate technical ability, and be capable of carrying through new developments in design, and the initiation of the necessary experimental work. The vacancy offers scope to a man of real ability, and none but suitable men need apply. Full particulars of experience, qualifications, age and salary required.—Address, 8971, The Engineer Office. 8971 A

ENGINEERS' ASSISTANTS, with Knowledge of Shield-driven Tunnel and Underground Work; must be capable managers of men and competent to Take Complete Charge of Shift.—Address, with age, salary and full details of experience, 8975, The Engineer Office. 8975 A

ENGINEER REQUIRED for a Colliery in the Midlands. Must be energetic and experienced in colliery work. State experience, terms, and give references.—Address, 8932, The Engineer Office. 8932 A

ENGINEER SALESMAN REQUIRED for India with Railway (Locomotive) Experience; single man of good appearance and address. State age and full qualifications.—Address, P5847, The Engineer Office. P5847 A

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SITUATIONS OPEN (continued)

MACHINE TOOL SALESMAN (also Small Tools) WANTED for Scotland and North-Eastern District by old-established firm; must know the ground and have good connection. State age, experience and salary expected.—Address, 8978, The Engineer Office. 8978 A

MAN REQUIRED to TAKE CHARGE of CASE-HARDENING and HEAT TREATMENT of large quantities of Small Parts; preference given to one who has had theoretical training, combined with practical experience with Continuous Rotary Furnaces. Midland district. State qualifications, age and salary. —Address, 8959, The Engineer Office. 8959 A

REQUIRED IMMEDIATELY, Thoroughly Capable and Experienced ENGINEER as WORKS MANAGER for Motor Engineering Works in Cheshire; must understand the Engines and Construction of the leading Commercial Vehicles, and be able to Organise Production on sound and economical lines. Age about 35.—Apply, with fullest details of experience and record confidentially, to MANAGING DIRECTOR, 56 and 58, Spear-street, Manchester. 8988 A

THOROUGHLY PRACTICAL INSPECTOR WANTED, engagement 10 to 12 months; must be well up in modern Shipbuilding Methods and with a good knowledge of Mechanical Engineering; some knowledge of Electrical Work an advantage. First-class men only, with considerable practical experience in this class of work, need apply.—Address, stating age, experience, salary expected, with copies of testimonials, 8996, The Engineer Office. 8996 A

CHIEF DRAUGHTSMAN FOR WAYS AND WORKS DEPARTMENT OF AN INDIAN RAILWAY.—GENTLEMAN, preferably bachelor not over 33 years of age, of good education, REQUIRED, who must have good general Engineering Experience, Civil and Mechanical, and knowledge of the latest practice in Reinforced Concrete Work.

He would Take Charge of a Drawing-office of about 30 draughtsmen.

Salary would be paid monthly in rupees, but would be equivalent to £450 to £700 per annum (according to ability). Applicant to provide his own quarters, &c.

An agreement for a period of years would be given.

As applications have to be referred out to India, this appointment will not be settled for some weeks.

Address in the first instance, with copies of testimonials and references, stating salary required, 9003, The Engineer Office. 9003 A

CHIEF DRAUGHTSMAN WANTED for Large Marine Engineering Works doing the highest class of work. Only those with wide experience need apply. —Address, 8895, The Engineer Office. 8895 A

DRAUGHTSMAN REQUIRED, North-East Coast, Must be thoroughly competent on all classes of Structural Work and Bridge Work; age 30 to 40. Full particulars, stating salary required.—Address, 8775, The Engineer Office. 8775 A

DRAUGHTSMAN REQUIRED for Colliery Screening Plants, Yorkshire; none but thoroughly experienced men need apply. Give experience, age and wages.—Address, 8994, The Engineer Office. 8994 A

INSTRUMENT MAKER WANTED for Experimental work; age 25-35; with General Light Engineering Experience; works near Macclesfield; fares paid for interview. Wages about £5 per week. Engagement six weeks or possibly permanency.—Address, P5858, The Engineer Office. P5858 A

CHECKER and DESPATCHER REQUIRED for small Structural Steel Shop; must be live, single, and fully qualified; competent to reject defective work; Drawing-office and Erecting Experience essential. State age, experience and salary required.—Address, P5851, The Engineer Office. P5851 A

SITUATIONS WANTED

A.S. WORKS ELECTRICIAN (34), DISENGAGED. Several years' varied experience, three large D.C. plants, capable charge, erection and maintenance; good education and refs.—Address, P5852, The Engineer Office. P5852 B

A.S. WORKS MANAGER, ENGINEER with Sound shop and drawing-office experience in loco., steam, general engineering, millwrighting, ironfoundry and repair work; good organiser, firm and tactful control of labour, thorough knowledge of bonus, costing systems and economical production. Excellent long-service references.—Address, P5825, The Engineer Office. P5825 B

BUYER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 619, c/o Deacon's, Leadenhall-st., E.C. 8934 B

CHIEF ENGINEER of Works DESIRES CHANGE, good general experience, first-class record, age 34, moderate salary and prospects, sound concern.—Address, P5727, The Engineer Office. P5727 B

ENGINEER, Late Manager of Small London Works, with good general engineering experience, SEEKS any RESPONSIBLE POST, anywhere; moderate salary; good references.—SNOAD, 36, York-road, Hitchin. P5857 B

ENGINEER (34), First-class Board of Trade certificate, DESIRES POST as RESIDENT ENGINEER or similar Responsible Position; 14 years' experience with the running and upkeep of turbine and reciprocating engines, also water-tube boilers; present chief of 6000 H.P. steamer.—Address, P5841, The Engineer Office. P5841 B

ENGINEER (33), ex-Officer, Mechanical and Electrical, DESIRES POST as Maintenance or Assistant Works Engineer; shop, D.O., general engineering and glass-works experience, home and abroad; has capital if required.—Address, P5842, The Engineer Office. P5842 B

ENGINEER (35) WANTS CHARGE of CONSTRUCTION WORK, abroad preferred; 8 years' foreign experience, marine reinfd. concrete, steelwork, &c.; fluent Spanish, some Portuguese and Italian.—Address, P5862, The Engineer Office. P5862 B

ENGINEER (42), CIVIL, late Major R.E., SEEKS ENGAGEMENT; 20 years' experience with contractors on all classes of constructional work at home, the colonies and abroad; accustomed to have full control large contracts and handle large bodies men. Fluent Spanish and Portuguese.—Address, P5846, The Engineer Office. P5846 B

GEARING EXPERT (Manufacture or Inspection), Engineer, Shop Foreman and D.O., 20 years' experience general engineering, ironfoundry, repairs, maintenance; excellent references, well educated, good address and smart appearance; age 35 years, WILLING to REPRESENT well-established firm of ENGINEERS anywhere.—Address, P5834, The Engineer Office. P5834 B

M.I.C.E. (45), Married, 22 Years' Experience, Railway survey, location, construction and maintenance, buildings, canal and harbour survey, ferro-concrete construction on large scale, employed on leading railway, owing to changed conditions in India SEEKS EMPLOYMENT elsewhere; excellent references, energetic, good organiser; suit large firm of contractors.—Address, P5831, The Engineer Office. P5831 B

SITUATIONS WANTED (continued)

ENGINEERING and BRASSWORKS MANAGER OPEN, late partnership, over 20 years' experience, approx. to works manager, with leading firms.—Address, P5836, The Engineer Office. P5836 B

SCOPE WANTED.—YOUNG MAN, Aged 22, thorough knowledge foundry and mechanical engineering, good knowledge of civil and general engineering, with a fair amount of electrical experience, SEEKS PROGRESSIVE BERTH, where grit and hard work will count; A.M.I. Mech. E. by exam., 1918; only to pass in French to get A.M.I.C.E.; will specialise in any department of works or will take up office work, including costs, estimating or any allied business; if necessary would study for B.Commerce Degree. At present in a permanent situation.—Address, P5845, The Engineer Office. P5845 B

SHIPYARD MANAGER, with Good Practical Experience and organising ability, SEEKS POSITION, home or abroad; excellent references.—Address, P5840, The Engineer Office. P5840 B

TWO ENGINEERS (24), Educated, French Linguist, matric., experienced erecting, general repairs, locomotive, marine, I.C. engines, power-house and general maintenance, D.O. and oil fuel, DESIRE PROGRESSIVE POSITIONS.—Address, P5856, The Engineer Office. P5856 B

WATER FINDING.—ADVERTISER, Trained as an Engineer and having the ability to find subterranean streams, WISHES to GET IN TOUCH with a good FIRM, with a view of obtaining a berth as a finder.—Address, P5843, The Engineer Office. P5843 B

FOUNDRY FOREMAN, Iron, Brass or Aluminium, SEEKS BERTH with small progressive firm; all classes of work, good organiser and expert metal mixer.—Address in confidence, P5754, The Engineer Office. P5754 B

ENGINEER CHARGE HAND (31), Single, Good turner and fitter, 17 years' experience, City and Guilds Technical College training; used to up-to-date methods of production; energetic; will go anywhere.—Address, P5849, The Engineer Office. P5849 B

WANTED, SITUATION as ENGINEER'S STOREKEEPER or other capacity in motor works; good knowledge of motor mechanism; 6 years' reference.—SMITH, Purton, Wilts. P5853 B

PARTNERSHIPS

ENGINEERING PARTNERSHIPS AND BUSINESSES.

Wheatley Kirk, Price & Co., 45, Watling Street, London, E.C. 4.

Established seventy years.

ENGINEERING FIRM, with Excellent Connections and valuable Patents, awarded highest diplomas at Royal and other Shows, REQUIRES FURTHER CAPITAL, as present orders and inquiries necessitate mass production. Directorship offered.—Address, P5832, The Engineer Office. P5832 C

PARTNERSHIP OR RESPONSIBLE POST REQUIRED, PATTERNMAKING OR FOUNDING.—ADVERTISER, with 20 years' Foundry and Pattern Shop Practice, is OPEN for PARTNERSHIP or RE-ENGAGEMENT. Schedules, estimates, weights, costs, patterns, drawings and works sketches; design of plant, gear for moulding machines, machine shop jigs, gauges, moulding plates, sprays, metal patterns and boxes, stricle gear, ovens, buildings, developing patent ideas; experience in railway, motor, electric, machine tool and general castings; checking patterns, inspection and marking-off, testing material; methods for mass production; use of skilled, semi and unskilled labour. Excellent references. Guarantees just terminated; 3½ years with the Wycliffe Foundry Co., Ltd., Lutterworth. Malleable and semi-steel.—W. STANLEY, Holmleigh, Gilmorton-road, Lutterworth. P5835 C

OLD-ESTABLISHED ENGINEERING FIRM in London WISHES to GET in TOUCH with (for preference) an ENGINEER to join, or one to INVEST by way of Debentures up to £5000 (which could be divided). Firm have been badly hit by anomalous working of E.P.D., and also by eighteen months of bad trade. Normal prospects excellent. First-class connection.

Replies treated in confidence.—Address, 9004, The Engineer Office. 9004 C

PARTNERSHIPS and ACTIVE DIRECTORSHIPS WANTED in Mechanical, Constructional, Electrical Engineers, &c., for Clients with technical experience and capital from £1000 to £20,000.—GILBERT and PRATT, 18, Walbrook, London, E.C. 4. Ex C

STRUCTURAL ENGINEER (30), with Good Practical and commercial record, is PREPARED to JOIN, as PARTNER, SMALL COMPANY manufacturing Structural Steelwork to supply driving force and little capital; would join small man with some plant.—Address, P5860, The Engineer Office. P5860 C

AGENCIES

BRAZIL: TO FIRMS CONTEMPLATING OPERATING IN.—COMMERCIAL and CONSULTING ENGINEER, just returned, free until end of year to DRAW UP or ADVISE on ORGANISATIONS for that country. Many years' experience Brazil, export and import; speciality, engineering agency work and reports, surveys and development of schemes in interior; translations of propaganda matter, &c. Until recently representative of London merchant firm handling many engineering agencies and managing partner of Anglo-Brazilian Company. Address, P5863, The Engineer Office. P5863 D

MANAGING DIRECTOR of Large Engineering Firm, with Show-rooms in Melbourne and Sydney, and affiliated Houses in Adelaide and Perth, will arrive in London on July 27th, with a view to securing AGENCIES for MACHINE TOOLS, WOOD-WORKING MACHINERY, SMALL TOOLS and ENGINEERS' REQUISITES.

SUITABLE AGENCIES are ALSO REQUIRED on an INDENT BASIS from Manufacturers of Rolling Stock, Mining, Hydraulic, Irrigation and all classes of Industrial Machinery.

Write with full particulars to Mr. SOMERSET, c.o. Union Bank of Australia, Head Office, 71, Cornhill, London, E.C. 3. 8955 D

REPRESENTATION.—A Well-known FIRM of ENGINEERS and EXPORTERS with connections in South Africa and offices in Westminster, would be pleased to act as AGENTS for ENGINEERING FIRMS desirous of extending their business.—Address, 8955, The Engineer Office. 8955 D

EDUCATIONAL

CORRESPONDENCE COURSES for Inst. C.E., Inst. Mech. E., London Univ. (Matric., Inter., and B.Sc.) personally conducted by Mr. TREVOR W. PHILLIPS, B.Sc. (Honours), Assoc. M. Inst. C.E., M.R.S.I., F.E.S.A., &c. Also Day Tuition in Office. Excellent results at all Exams. Courses may commence at any time.—9/11, Trafford Chambers, 58, South John-street, LIVERPOOL. Ex.

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THE PROPRIETOR of the New BRITISH PATENT No. 8788/22, dated 27th March, 1922, re "APPARATUS for CENTRING WORK for TURNING and the like," is DESIROUS of ENTERING INTO NEGOTIATIONS for the GRANT of LICENCES to MANUFACTURERS on ROYALTY or otherwise, or to TREAT for the SALE of PATENT OUTRIGHT.

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For continuation of For Sale Advertisements see page 3.

JULY.

Unemployment.

Answering a question addressed to him in the House of Commons on the 27th of the month by Captain Wedgwood Benn, the Prime Minister said that a Cabinet Committee had the whole problem of unemployment during the coming winter before it and that another Committee had been appointed to consider questions of trade and employment. Steps, he said, had already been taken to find out from local authorities what schemes for public works might be put in hand to relieve distress. Pressed by his interrogator to say if he was satisfied that such measures would be sufficient to deal with any emergency that might arise, he replied that the Government was "doing its best." It is apparent from these questions and answers that in political circles a sombre view of the trade position is still held, and that in these circumstances no other plan than the prosecution of relief works has been advanced. It may be hoped that the new Cabinet Committee which will investigate the general condition of trade and unemployment will reach some valuable conclusions and even find itself in a position to make proposals that may lead to the only course which can decrease unemployment—a genuine revival of trade—but we fear no more than a pious hope of such a conclusion of its labours can be entertained. A step in another direction which may lead to fruitful results was also taken last week, when the coal industry set up a Committee to investigate the problem of that industry, which for some months has been advancing towards a dangerous condition that is but little relieved by the American demand. The issue before this Committee is a decrease of the selling cost of coal by the minimisation of certain colliery and transport charges. It is held in some quarters that a material reduction in the cost of coal would lead to a general revival of trade. That is but one factor in a world problem, but by satisfying it a step towards a complete solution would be made.

French Public Works.

If the vast scheme of public works to be carried out in France is to be completed within the allotted time it will only be possible by means of the plan which the Government has just presented for the approval of the Commission of Reparations. The Minister of Public Works, M. Le Trocquer, has prepared a scheme whereby the German Government will be required to supply all the labour and the greater part of the material for the Rhone navigation works and other undertakings. If the Germans consent to wipe out a part of their reparation in this way, France will, in a comparatively short time, be remarkably equipped for its future industrial expansion. Of much more immediate importance is the operation of the Wiesbaden agreement under which Germany has undertaken to supply material for reconstruction purposes, as well as machinery and other goods needed for industrial development, in which latter case buyers will pay the French Government as a set off against the reparation. The application of the Wiesbaden agreement is already giving rise to many difficulties, not only on account of the possible openings for dishonest speculation, but also through the fear of French manufacturers that the German goods will be sold at too low a figure. The trouble centres mainly in the question of import tariffs, upon which the Minister of the Liberated Regions and the other Government departments are not in agreement.

The Royal Agricultural Show.

If not so successful as in the last few years either from the gate money point of view or from the amount of business transacted by the implement makers, the recent Cambridge show was one of the most instructive from the engineers' standpoint that we can recall. The exhibits in the implement section numbered 4866, distributed over nearly 500 stands, and included a larger percentage than usual of new and meritorious productions which were entered in the competition for the Society's silver medals. The adverse conditions under which the engineering industry has recently been conducted certainly accounted for the absence of several well-known exhibitors. Their absence was, however, more than compensated for by the presence of quite a number of new, if less important, exhibitors, whose products afforded an interesting contrast to the more stereotyped exhibits. The most marked feature of the engineering section was the very large number of small self-contained electric generating sets suitable for country houses and estate purposes. Much originality is shown in the design of these plants, some of which are so diminutive that they can be carried about, while the prices at which they are being placed on the market bring them within the means of a very large section of house and estate owners in remote districts, who have hitherto had to be content with such primitive methods of illumination as oil lamps and candles. As a gathering centre for all who are interested in agriculture the Royal Show seems quite able to hold its own.

The Engineers' Ballot.

Following the conclusion of the dispute in the engineering industry regarding the exercise of "managerial rights" by the employers, fresh cause for anxiety arose as a result of the employers' proposal to reduce the war bonus paid to the men by three equal instalments of 5s. 6d. each. The executives of the various unions involved submitted the proposal to the ballot vote of their members, with the result that 70,900 voted against it and 43,937 in favour of it, showing a majority against acceptance of 26,963. Although the total vote was small—it represented about 12½ per cent. of all those affected by the proposed reduction—the adverse result of the ballot aroused fears of fresh trouble. Subsequent to the announcement of the ballot result, the employers intimated that there was a time limit to their offer, the alternative being an immediate reduction of the whole sum of 16s. 6d. in one step. Negotiations are proceeding, but in the meantime the union executives have recommended the men to continue at work.

New Oil Dock on the Manchester Ship Canal.

The new oil dock which was opened during the month near Ellesmere Port, on the Manchester Ship Canal, is likely to prove an important source of revenue to the company, which has hitherto declined to permit cargoes of oil and spirit of a flash point below 73 deg. Fah. to enter the canal. By means of this new undertaking the largest oil tankers will be allowed to enter the canal and discharge their bulk cargoes with every possible precaution which can be taken to secure immunity from danger of fire. With this object, when a ship enters the dock all fires are extinguished and the crews removed, steam for operating the pumps being provided from a boiler-house 100 yards distant from the dock itself. In order to prevent any possibility of burning oil or spirit entering the canal, Mr. Reed, the canal company's engineer, has designed a ferro-concrete caisson which is floated across the entrance to the dock when the contents of a vessel are being discharged. The dock is 600ft. long, 100ft. wide, and the depth of water is 30ft.

French and British Research.

The Inventions Committee which was instituted in France during the war has, like the corresponding British organisation, been transformed into a permanent Direction des Recherches et des Inventions, with laboratory and workshops at Bellevue, near Paris. An address delivered by M. Legendre upon the work done by this department was not the least interesting of the matters discussed during the month at the Congress for the Advancement of Sciences at Montpellier. M. Legendre explained the practical utility of the Direction des Recherches in offering facilities to inventors for working out their ideas when they appeared likely to have any real value. He also referred to the results obtained with the tele-mechanical apparatus for navigating boats, the submarine searchlight, the Cornu lighter for acetylene blow-pipes for use under water by divers for cutting ships' plates, variable surface aeroplanes, the resistance of air to trains and many other matters that have been worked out by scientists and inventors at Bellevue. The resources of the Direction des Recherches are very restricted, but it is hoped eventually to transform this organisation into an Office National, when it will be able to extend its operations with the aid of a participation in the profits derived from the inventions it helps to realise.

An Unusual Railway Derailment.

On the 3rd of the month was issued the report of Major Hall as to the derailment on April 21st of a Midland express from London to Manchester at Johnson's Siding signal-box, less than a mile north of Ambergate, where, as all regular travellers by the Midland route know, there is a series of reverse curves over which there is a speed restriction of 15 miles per hour. The series of curves continues, but less severely, past the site of the derailment. The train consisted of seven eight-wheeled and two twelve-wheeled bogie vehicles, the twelve-wheeled being the seventh and eighth respectively. It was drawn by two engines, and it is important to note that the assistant engine had no radial motion. It was the last six coaches, as well as the trailing pair of wheels of the third vehicle from the engine that left the road. There were no personal injuries. The derailment occurred at a diamond crossing where a through road from the up line to a siding on the down side intersects the down main line. There is not the slightest doubt as to the engines and carriages being in good order, and there is no question of unsuitable speed. Nor is it proved that the permanent way was not in good order, but the effects of the derailment suggest that the key was out of the knuckle chair, and perhaps out also of the chair immediately in its rear, of the right-hand crossing, so that the wheels gradually slipped down between the check and the point rails, and the flanges struck the noses of the two point rails, leading to derailment. Against this suggestion there is the positive testimony of the ganger—a man of thirty years' service, with a first-class record and known as a particularly careful observer—and two of his men who were standing near when the express passed, that no keys were removed and that they were all in position immediately afterwards. The possibilities of an obstruction in the crossing were fully investigated. The crossing showed distinct signs of wear but had not reached the safe limit of its life, and, as we read the report, it would seem that the amount of super-elevation given is greater than is necessary, seeing that the situation is so close to Ambergate, where the speed restriction of 15 miles per hour is always respected. This possible excess of super-elevation and a 14 p.c. wear on the running edge of the left-hand rail immediately south of the crossing would tend to force the wheels to the left of the correct gauge line. If such be the case, the damaged inner edge of the right-hand wing rail just south of the knuckle and the marks on the right-hand wheels of the engines and carriages may be accounted for. The derailment possibly then arose through the wing rail north of the knuckle being bent inwards by the extra stress south of the knuckle.

A Half Year's Civil Aviation.

The half-yearly report on the progress of civil aviation issued towards the end of the month by the Air Ministry, recorded little, if any, commercial development during the period from October 1st, 1921, to March 31st, 1922. A small increase in the number of passengers carried was accompanied by a large drop in the value of the goods imported and exported between this country and the Continent, and by a fall of over two-thirds in the number of outgoing and incoming letters. On the technical and organisation sides, however, a little progress was recorded in the report. In connection with signalling and navigation a system was introduced whereby in bad weather a pilot flying within a radius of about ten miles from Croydon can be informed of his position by means of a "sound locater" and wireless telephony. The combination of line and wireless telephony was successfully experimented with by connecting the Croydon control tower telephone by line to the wireless apparatus. By this means an office in London was enabled to speak directly with an aeroplane in flight. The arrangements made to permit of flying by night on the London-Paris route were brought to a state of completion sufficient to enable them to be put in use at short notice. These arrangements consist of various route lights and illuminated wind-indicating signs, and are constructed to operate for a year without attention. For use in foggy or misty weather an improved design of beacon flare, giving an intensified colour light, was evolved. The total sum for civil aviation included in the Air Ministry estimates for 1922–23 is £364,000, not counting £35,500 for the headquarters staff and £51,000 for the Meteorological Office. Of this sum, £200,000 is to be applied to the direct assistance of approved firms operating cross-Channel air services. Under the hire-purchase scheme by which the companies can acquire machines built by the Ministry, the sum to be received is estimated at £16,000.

An Engineers' Entente.

The recent visits of the "Mechanicals" and Naval Architects to Paris have given more immediate results than are usual at gatherings of this kind. The visits took place at a time when there was a growing desire amongst the intellectual classes to promote an active collaboration between France and Britain, and the sympathetic attitude of British engineers, and their obvious readiness to work in harmony with their French colleagues, have had a result which is as unexpected as it is agreeable. The Société des Ingénieurs Civils de France has long been in direct touch with British engineering progress through its branch in London. It has recently extended its activities in the way of collaboration by an agreement with the

Association France-Grande-Bretagne, whereby the Société des Ingénieurs Civils de France undertakes to do in its own sphere what the Association has accomplished so successfully in the way of political and social propaganda work. No doubt the outcome of this agreement will be more frequent meetings between British and French engineers and a freer interchange of ideas which cannot fail to be of benefit to general engineering progress. The methods of research and development on both sides of the Channel are so different that much more could be done by associating than by each nation pursuing its way independently. The purely scientific character of French investigations often gives less immediate practical results than the British, which are both scientific and practical, and if the Société des Ingénieurs Civils de France succeeds in carrying out its programme of collaboration it will enable the British to profit from the high scientific attainments of the French, while our French friends, who are positive in their scientific methods, may learn to realise them in a more practical manner. It is a common complaint in France that inventions and ideas are only brought out there to be developed in other countries.

Electrically Operated Trains in Euston.

The 10th of the month saw the completion of a work for which the London and North-Western Railway Company obtained powers in 1907, and the first stage of which was opened in June, 1912, and the second in February, 1913. This was the provision of a fifth and sixth running line between Chalk Farm and Bushey, a triangle between the main line at Bushey and the Rickmansworth branch with its base on the latter, the widening of that branch and a line therefrom to Croxley Green. All these lines were to be operated electrically, and the North London, Hampstead Junction, North and South-West Junction and West London Railways were to be converted from steam operation to electric traction. The penultimate stage was reached during the war, when the Elephant and Castle-Watford service was brought into use. Work was then necessarily suspended, for about three years, on the remaining portion, which included twin tunnels, 1330 yards long, under Primrose Hill, the provision of two additional lines between Chalk Farm and the junction at Queen's Park with the London Electric Railways and a very complicated re-arrangement of the lines at Chalk Farm in order to do away with any crossing on the level of any running lines. The slow lines between Euston Station and Chalk Farm had to be equipped for electric traction, also the lines from Chalk Farm to Kentish Town junction on the North London Railway. The whole of this work having been completed, it was inspected by Colonel Pringle, on behalf of the Ministry of Transport, on the 5th of the month, and, as said above, opened for public traffic on the 10th.

Safety of St. Paul's.

It has been necessary for the Canon and Treasurer of St. Paul's Cathedral to make a new appeal for funds for the preservation of the famous fabric of St. Paul's Cathedral. It is common knowledge that work has been in progress at the cathedral for the past nine years, but the funds subscribed are now nearly exhausted, and as the result of a report which has just been made by a commission of experts, it has been decided to ask for a sum of £100,000. The Commission consists of Sir Aston Webb, Mr. E. F. C. Trench, chief engineer to the London and North-Western Railway, Mr. G. W. Humphreys, chief engineer to the London County Council, Mr. Basil Mott, and Mr. Mervyn Macartney, the cathedral architect. The report states that while the Commissioners are not yet prepared with final recommendations, they are unanimously of opinion that the surface of the piers and arches supporting the dome should be examined without delay in order that protective measures may be taken regarding loose and defective stone work. The Dean and Chapter have accordingly decided to put this work in hand at once and to suspend for the time being the general course of the repair work on which upwards of £60,000 has been expended since the year 1913. It is, however, hoped to finish the repairs in the south transept which are now nearing completion. The sum of £100,000 is the minimum which will be required to carry out the most necessary repairs and represents only a small part of the total sum likely to be needed before the cathedral structure can be restored to a safe and satisfactory condition. Sir Thomas Jackson has stated that the weight of the dome is practically taken by the ashlar facing of the piers, which is in many cases less than 1ft. in thickness. Unless, therefore, the mischief is arrested, the fall of the dome is, he believes, only a matter of time. To enable the new work to proceed with expedition the entire closing of the cathedral is being seriously considered.

New Shipbuilding Rules.

Not since the year 1899 has any revision been made of Lloyd's Register rules for the construction and classification of steel ships, and the revised rules which were issued towards the end of the month are somewhat overdue. The issue of new rules at this juncture is very opportune, as they make for simplification of design and for a reduction in the weight of steel employed, and should therefore assist in the solution of the difficult problem of cheapening the cost of ship construction, which is essential if a revival in the shipbuilding industry is to be brought about. The general effect of the change now made will be to abolish what is known as "type" classification, and to bring the regulations into line with all those modern ideas regarding design and construction for which experience has indicated that a sound basis exists. What has now been done is the outcome of the research work which has been prosecuted during recent years and the knowledge which has been accumulated of the part played by the various members of a ship's structure in meeting the stresses imposed by service conditions. The tables which have been prepared are for two classes of vessels—the full scantling vessel, which obtains the maximum loading permissible by dimensions, and the complete superstructure vessel in which the scantlings are adjusted to a freeboard approximate to that of the present shelter deck type with tonnage openings. The proper scantlings for vessels intermediate between the two classes can be ascertained by calculation. One result is that designers and builders will be allowed some latitude in adjusting the deadweight and capacity for cargo, and another that a better relation can be obtained between deadweight carried and weight of hull. There is general agreement as to the justification for the increase of framed spacing provided for in the rules. The old rules for the construction of oil vessels are now withdrawn, the intention being to issue a new set at an early date. The official date for the coming into force of the new rules is six months after July 13th, the day on which they were approved, but they can be adopted immediately if desired.

New Railway in Devonshire.

The beginning made during the month with the construction of the standard-gauge light railway which will link Torrington, in North Devonshire, with the Okehampton and Bude line of the London and South-Western Railway, is the first step towards the realisation of a scheme for which parliamentary powers were obtained as long since as the year 1880. The length of the line is about 27 miles, and it will not only provide new railway facilities for the china clay industry, but will serve important agricultural interests and effect a material shortening of the railway route between North Devon and the ports of Plymouth, Fowey and Falmouth. It has only been possible to put the work in hand now with the co-operation of the Ministry of Transport, which has arranged a Government contribution to the capital cost of the work of £125,000, which is 50 per cent. of the estimated total outlay. The engineering features of the line are of a somewhat conventional character. For some miles from the Torrington end the route followed is that of an existing private mineral line of narrow-gauge, built forty years ago for the requirements of the china clay trade, and work on this section will be in the nature of reconstruction. Beyond Peters Marland, the terminus of the old mineral railway, the line will be entirely new, and will include some heavy cuttings and embankments, a notable feature being a viaduct which will carry the railway over the river Torridge. The chief centre to be served is Hatherleigh. It is anticipated by the contractors—Messrs. T. and W. Anderson—that the work will be completed by the end of next year.

Electricity and Coal.

The proposal to distribute electrical energy all over France, and even to remote rural districts for agricultural purposes, made further progress during the month by the presentation of reports by the Commission appointed to investigate the matter in its different phases. These reports are to be embodied in a Bill which will be introduced into the Chamber of Deputies. The object of the proposed measure is to provide facilities for local bodies and societies to establish generating stations with the assistance of the State. At the same time the Chamber has passed a Bill authorising the State to exercise control over all the high-tension mains to be laid down under the national distribution scheme. There is no question of the Government taking over the national service, and its control will be limited to preventing the formation of trusts or monopolies, and generally to watching over the interests of consumers. Despite the financial difficulties at the moment, the laying down of hydro and thermic electrical generating plants has made more headway than is generally supposed. It is regarded as the most pressing economic problem, in the sense that it will hasten the time when France will no longer be required to spend money on foreign coal, and the possible future suppression of the French market is a matter that British coalowners will have to take seriously into account.

Mid-Scotland Ship Canal.

On the last day of the month the project for a ship canal between the Forth and Clyde was again brought forward at the first annual meeting of the Mid-Scotland Ship Canal Association which has been held since the war. The meeting took place at the Royal United Service Institution. The engineering features of the two main schemes which have been proposed for a water way either by the direct route or the Loch Lomond route have been described on various occasions in The Engineer, particularly in connection with the detailed reports made on both proposals by Armstrong, Whitworth and Co., Limited. It was stated in the report presented at Monday's meeting that experts were still hopelessly divided as to the relative advantages of the rival routes, and that what is now needed is a Commission on which engineering experts, shipping interests, and the Admiralty would be represented to pronounce final judgment on the merits of the two schemes. It was argued that the indifference of neither shipowners nor the Government should discourage those who believe in the national importance and commercial possibilities of the waterway. Shipowners, the meeting was reminded, did not construct the Suez, Panama, or Manchester Ship canals. Glasgow interests represented at the meeting questioned the need of reopening discussion on the route problem, as, in their opinion, the only project worth consideration was for a waterway from Grangemouth to Yoker by the direct route. The outcome of a long discussion was a unanimous decision to request the Secretary for Scotland to press on the Government the desirability of constructing a canal by the direct route on the ground that it was a work of national importance which, if undertaken at the present time, would absorb a large body of unemployed who were in receipt of doles. The Earl of Cassillis was elected chairman of the Association.

The Stability of the Sailing Warship

No. II.*

By A. W. JOHNS, C.B.E., R.C.N.C., M.I.N.A.

With the extensive developments made in the early part of the sixteenth century in the design of ships, stability became a matter of primary importance. The largest ships were now fitted with three or four masts carrying main, topsail, and topgallant yards on the fore and main mast and lateen sails on the mizen and bonadventure mizen masts in the case of four masts. The rigging arrangements permitted the yards and their sails to be braced around so that the ship could be sailed with the wind on the beam. To attain the greatest speed in chasing as much sail as practicable had to be carried. The heaviest guns of a ship's armament were fitted on the lower deck and the lowest tier of gun ports had to be kept open in action if the maximum weight of broadside was to be brought to bear on the enemy. If the wind were on the beam the ship heeled under the pressure on the sails, and if she possessed little stability the angle of heel was large.

From 1217, when Hubert de Burgh defeated the French fleet under the renegade Eustace the Monk, the English commanders had orders to obtain the weather gauge when attacking the enemy. This position necessitated fighting with the lee broadside. The opening of the lowest tier of gun ports on the lee-side depended upon the angle of heel and also upon the height above water of the port sills when the ship was upright. If the heel and height were such that the ports could not be opened, the heaviest guns were out of action and the offensive power of the ship seriously diminished. If the angle of heel were reduced by shortening sail, speed was lost and also touch with the enemy. But even if the port sills were high enough to allow the ports to be opened it did not follow the guns could be most effectively used. The maximum angle of elevation given to the guns was 9 deg., and if the heel were less than this the guns could be fired at a small elevation, but if more they could only be fired at a depression, and unless the ships were close together the shots struck the water between.

The enemy ship to leeward had an advantage, for

* No. I. appeared July 28th.

she was fighting with her weather broadside. As only the guns of one side were manned, the weight of the guns' crews tended to decrease the heel caused by the wind on the sails. The weather gun ports could all be kept open and the whole broadside brought to bear. The maximum angle of depression given the guns was 7 deg., and if the heel were less than this they could be fired horizontally or at a slight depression. If more, they had to be fired at an elevation; but then the shot could seriously damage the sails, mast, spars, and rigging of the opponent. In such circumstances it is not surprising to read that English seamen closed with the enemy and endeavoured to carry her by boarding. The possession of the weather gauge favoured this tactic. According to accounts, the French seamen preferred a long-range gun duel.

The problem set the naval constructor of the time was clear and definite, but in the absence of any theoretical knowledge, was more difficult than in any preceding or succeeding type of warship. They had to give the ships sufficient stability to meet the conditions just outlined. It was a problem of initial stability, *i.e.*, of stability up to 9 or 10 degrees of heel. With our present knowledge the satisfactory solution is not difficult, but without it the problem proved almost insuperable.

At the time the sailing warship was in the infancy of its development and design was necessarily in a crude condition. The form and dimensions given to ships were determined by rules of thumb passed down from one builder to another and based upon those of some vessels which report had stated were better than others. There was no central controlling authority for preparing or examining designs, and these were left to the builders at the yards selected for the construction of ships. As a result ships nominally of the same dimensions and qualities differed considerably, and none could explain the differences. At first size and appearance were considered of primary importance, until experience at sea or in action proved other qualities were more essential. Improvements in design and construction were kept secret and handed down from father to son as precious heirlooms. Pepys in his diary relates how Sir Anthony Deane explained "a secret which the King and all admire in him and he is the first that hath come to any certainty of foretelling the draught of a ship before she is launched." This was in 1665, after a century and a-half of warship building.

The famous family of the Petts was building warships between 1540 and 1690, and it might have been expected that the accumulated experience of two or three generations would have enabled Christopher Pett, master shipwright at Woolwich from 1652 to 1668, to build a warship far superior to those of his contemporaries. Yet Jonas Shish, according to Evelyn and Pepys, a most illiterate man, built the better warship so far as its stability was concerned.

Often ships, captured from the enemy, were found to possess superior qualities to those of our own and were used as models. The Regent, already mentioned, was a copy of the French Columbe, and the Harwich of 1673 of the Superbe, and there are numerous other examples. So long as a faithful model was made the results were satisfactory, but often improvements were introduced and failure resulted.

In such circumstances no one had the temerity to predict what the qualities of a new ship would be, and it was not until her completion and trials that they could be ascertained. The records show that the results were usually unsatisfactory. Ships lacked the necessary stability, and modifications had to be made before they could take their place in the fighting line.

The first and easiest remedy was to add ballast. Experience showed this practice had a beneficial effect, but the reason for it was not understood until long after. The addition of ballast beyond that allowed for in the design had the disadvantage of increasing the draught and bringing the port sills closer to the water. The material used for ballasting was gravel or shingle and required such a large amount of hold space as seriously to decrease that which could be allocated to stores, provisions, and water. The time for which a ship could remain at sea was thus sensibly shortened, and if a long voyage became necessary the ship or fleet had to be accompanied by special vessels termed victuallers carrying provisions and water.

The amount of ballast carried by these old warships is not stated, but must have been very considerable. In the reign of Henry VIII. a ship named the Kateryn Plesaunce was built for the special purpose of carrying the King and Queen across the Channel. Her tonnage is given as 100 and she had to carry 80 tons of ballast, a large proportion of her carrying capacity.

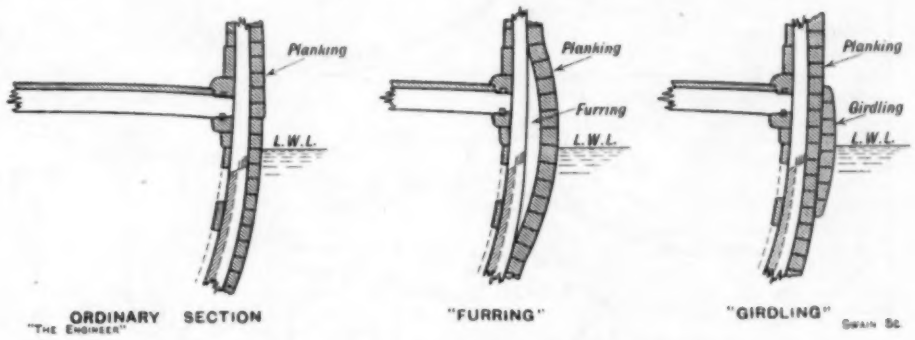
Gravel or shingle, with its disadvantages of great bulk and high centre of gravity when stowed, was not displaced as the material for ballasting until well into the nineteenth century. In 1783 large three-deckers carried 340 tons of shingle and 140 tons of pig iron, whilst in 1812 they carried 60 tons of shingle and 340 of pig iron. In 1672 Phineas Pett, building the Prince at Chatham, suggested 300 tons of lead ballast for that ship. As the cost of the lead—£5250—was as much as that of building a second rate, the proposal was not approved.

In many of the earlier ships the amount of ballast required for ensuring sufficient stability could not be added either from lack of hold space or the position of the lowest ports, and other methods had perforce to be resorted to. In such cases either furrings or girdlings were fitted. With the former several strakes of planking in the region of the water line were removed, the outsides of the frames were packed with pieces of wood and the planking refitted on these modified frames. In the case of a girdling additional strakes of planking were fitted outside the original thickness and in the vicinity of the water line for perhaps seven or eight strakes in depth. With both methods the breadth of the ship at the water line was increased and, as we now know, the metacentre was raised by an amount approximately equal to the thickness of furring or girdling. The centre of gravity of the ship remaining practically unaltered in height, the metacentric height was increased by the rise in the metacentre—see the sketches below.

It is not stated at what date these methods of increasing stability were adopted or who was responsible for their introduction. A writer in 1624 observes that the Dutch ships could sail around the English, whose crankness was only imperfectly remedied by furring or girdling. Another writer of about the same period—Sir Henry Mainwaring, who wrote the "Seamen's Dictionary"—states "they are a loss to builders and deserve punishment. In all the world there are not so many furred as in England."

The advantages of a girdling are well expressed by Sir Cloudsley Shovell in a letter written in 1692 and referring to the Royal William, just then completed:—"It is certain a girdling will make her stiffer and then they may venture her with 80 or 100 tons less ballast, which together will occasion her to carry her guns higher. Further, it will make her almost shot free between wind and water, and consequently not in so much danger of sinking."

In his "Naval Register," Pepys mentions many ships which had been girdled or furred. In one case, the Bonadventure, of 48 guns, the breadth as built in 1649 was 29½ft. On rebuilding in 1663 it was increased to 30½ft., and on again rebuilding in 1683 to 32½ft. The Prince, of 100 guns, built in 1660,



SKETCHES ILLUSTRATING METHODS OF INCREASING STABILITY

had breadths of 44¾ft. and 45 ⁹/₁₆ft., and the Charles Royal, of 100 guns, built in 1673, breadths of 44¾ft. and 46ft. The Constant Warwick, a famous frigate, had her breadth increased from 27ft. to 28½ft. The examples show that girdlings were from 6in. to 9in. in thickness.

The beneficial effect of increased beam on a ship's stability appears to have been very generally recognised, for the records show that the majority of ships when rebuilt had their beam substantially increased. The Vanguard, built in 1586, had a beam of 32ft., which was increased to 35ft. when rebuilt in 1615. On again rebuilding in 1630 the beam was made 36.4ft., which indicates the addition of a girdling. The Defiance, built in 1590, with a beam of 32ft., had it increased to 37ft. when rebuilt in 1612, and there were many similar cases.

Although increase in breadth was known to improve stability, the reason for the difference was not understood. Records show that the naval architects and naval officers of the time considered the breadth should bear a certain proportion to the length to secure the best results. Raleigh states that "100ft. long and 35ft. broad is a good proportion for a large ship." A commission in 1618 reported that "in the judgement of men of best skill, both dead and alive, shippes should have a length treble the breadth and breadth in like proportion answerable to the depth, but not to draw more than 16 feet of water."

William Borough, a naval officer and Comptroller of the Navy from 1589 to 1598, gives the proportions of length of keel, breadth and depth of hold in three "orders" of ships. The first "order," "used in some merchant ships for best profit," had the breadth half the length of keel and twice the depth. The second "order," "which is the mean and best proportion for shipping for merchandise," had the breadth from four-ninth to one-half the length and twenty-four-elevenths of the depth. The third "order," for "galleons or ships for the wars made for the most advantage of sailing," had the breadth one-third the length and two and a half times the depth. Very approximately, the depth of hold was equal to the draught of the main body of the ship, *i.e.*, the total draught with the depth of projecting keel taken off. The ratio breadth to draught therefore varied in the three "orders" from 2 to 2.5.

Captain Waymouth, another expert, writing later—probably about 1618 or 1620—gives two tables of dimensions for warships and one for merchant ships. In the first table the ratio of length to breadth is 3.4 and breadth to depth about 2.8. In the second table the ratios are respectively 3 and 2½, and these figures are also given for merchantmen. A table for galleys shows the ratios 6 to 6½ and 4. It is not clear from Waymouth's writings if these data were taken from actual practice or were recommended by him as a result of his study of the matter. The second table for warships was evidently based on the recommendations of the 1618 Commission. When it is remembered that in modern warships the ratio of breadth to draught is seldom less than 3, and the great difference in the amount of top hamper in the sailing warship and the modern type, the difficulties of securing satisfactory stability in the former can be appreciated.

The first of the "great" English warships was the Henry Grace à Dieu, completed in 1515. It is stated that she was built in imitation of the Great Michael, a Scottish warship, built in 1506, with a length of 240ft., a moulded breadth of 35ft., and sides 10ft. thick. She was designed and built by a Frenchman, and was lost on a voyage to France in 1512. The thickness of sides suggests many girdlings.* The dimensions of the Henry were kept secret, but it is usually stated that she was 138ft. long on the keel, 36ft. beam, and 22½ft. draught. She carried 80 guns—some accounts say 122—and was the first British ship fitted with gunports between decks. She had four masts and a bowsprit which was given such a "stieve" that landsmen counted it as a fifth mast. Her rigging allowed for the yards being braced. Her poop and forecastle erections were of excessive height, as was the fashion of the time. The small proportion of breadth to draught and the excessive top hamper suggests a lack of stability, and it is not surprising to read that on completion she nearly capsized. Alterations were made, and, according to a report in 1522, she sailed as well or better than any ship in the Fleet, with the exception of the Mary Rose. It is probable, therefore, she was furred or girdled between 1515 and 1522. Originally quoted as of 1000 tons, she was later stated to be nearer 1500 tons, and this addition could only be explained by an increase in beam. Her name was changed to the Edward in 1552, and a year later she was destroyed by fire.

The Mary Rose, built in 1509 and rebuilt in 1536, a ship of 500 tons, mounting 85 guns, six being in the mast tops, with a crew of 400 men, was one of the finest of Henry VIII.'s Fleet. She sailed out in company with the Fleet to attack the French ships off the Isle of Wight on July 20th, 1545, and in tacking she heeled, allowing water to enter the lee gun ports, which had not been closed. The entry of water increased the heel, the weather guns, which were not secured with breechings, slid across the deck, and she capsized, with the loss of nearly all the crew. According to Raleigh, the lower port sills were only 16in. above water. This disaster, witnessed by all the Fleet, must have forcibly impressed them with the danger of keeping the gun ports open and having them so close to the water.

"Great" ships were not popular in Elizabeth's reign, and the four largest ships in her Navy—the Triumph, 955 tons; White Bear, 915 tons; Merhonour, 865 tons; and Elizabeth Jonas, 855 tons—very rarely put to sea. They were reported as being too big, expensive and unhandy, and consequently the naval work of the reign was carried out by the smaller units. Pictures of ships of the period suggest unhandiness, for they show a towering poop erection, against which the forecastle appears small. This great height aft and the absence of head sails, not introduced until long after, must have brought the ship up into the wind continually. Alterations made in the breadths of the Merhonour, Dreadnought, Defiance, Rainbow, Vantguard, Antelope, Golden

* A survey of naval ships made in 1525 disclosed the fact that the Gabriel Royal, a Genoese carack purchased by Henry VII., had five thicknesses of planking in the region of the water line. It is probable, therefore, that girdlings were introduced by the Italians.

Lion, and many other ships of the time as they were rebuilt, show that attempts were always being made to improve their stability.

Many improvements were made by Sir John Hawkins in this reign, the most important being the decrease in top hamper by which the stability was improved.

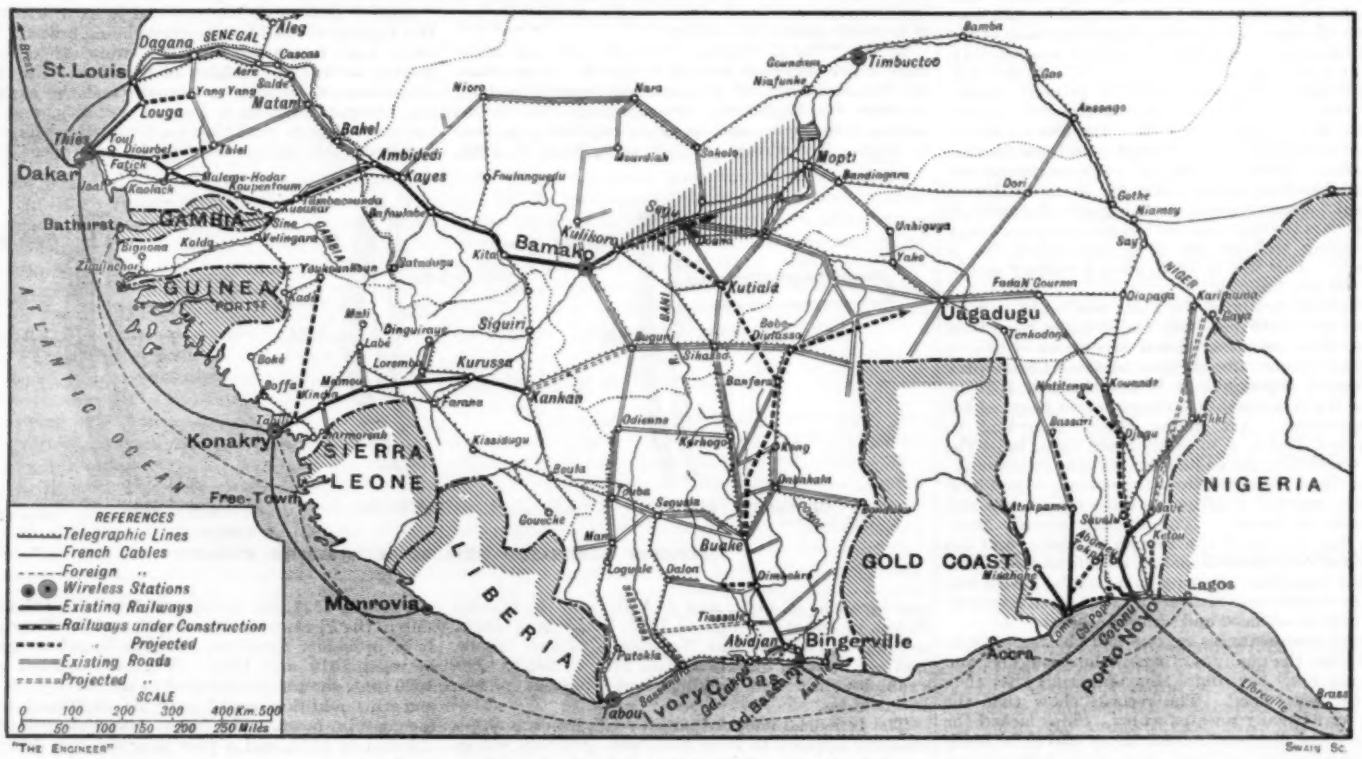
In 1588 the first of many similar Commissions settled the dimensions of three ships—Defiance, Merhonour and Guardland—which were ordered to be built. This committee consisted of Hawkins, Drake, Borough and Matthew Baker and Richard Chapman, both master shipwrights. The three ships were afterwards broadened to increase their stability.

French Colonial Public Works.

No. II.*

The object of the French Government in carrying out its policy of colonial development is mainly to create a cotton and grain-growing industry sufficiently important to satisfy the home needs. The supplies of all other products such as rubber, palm oil, timber, and wool, will grow normally with the provision of transport facilities; but in the case of the vast territories where it is proposed to produce cotton and cereal crops the labour problem is a serious one, and can only be solved by improving the sanitary conditions under which the native population lives. The heavy mortality and the sparseness of the nomad populations in the French Sudan have shown the Government the necessity of encouraging a settlement in centres where the living conditions can be improved and the natives are available for labour. Much has already been done in this direction, but it will evidently be a long time before the valley of the Niger can be developed to anything like the same extent as the regions nearer the coast. It is hoped that the system of roads and railways will permit of a more regular distribution of the population according to the needs of local industries.

One of the drawbacks of French West Africa—see map—is the smallness of the coast line for the area of territory to be opened up. The British and Portuguese possessions and the Republic of Liberia have absorbed the best parts of the coast, and apart from Dakar and Konakry there are few sites where it is possible to create ports and harbours capable of dealing with the considerable traffic which it is hoped will grow up eventually with the Niger district. The idea of making St. Louis a leading port had to be abandoned on account of the sand bars at the mouth of the Senegal, and Dakar was therefore selected as offering good accommodation for ships at all seasons. Under the Sarraut programme a sum of 55 million francs is to be spent upon making Dakar the port of call for inter-continental steamship lines. The first step to be taken was to construct the line from St. Louis to Dakar, and then the scheme of General Faidherbe of building a railway along the Senegal and Niger valleys, a distance of about 3000 kiloms., was taken up tentatively. All the railway schemes have aimed at reaching the territory within the bend of the Niger, where the populated country is regarded as particularly fertile; but in the absence of any definite programme the railways have not been laid out to the best advantage. The idea of the Sarraut programme, developed at the recent Colonial Congress at Marseilles, was to organise and carry out a general scheme whereby all the existing lines of communication should be merged as far as possible into one plan for the opening up of the Niger and Sudan territories. It is now recognised that Dakar, being the farthest removed from the Niger valley, is not the most favourably situated for dealing with traffic from that territory, which can be placed in much shorter and therefore cheaper communication with the seaboard by way of the Ivory Coast, where, however, there is at present no suitable port. Nevertheless, Dakar commands a very rich and important part of West Africa, and, as the railway system is well developed, there is reason for believing that it will continue to grow in importance as the leading port of shipment to Europe and America. At present Dakar is in communication with the Niger at the point where it begins to be navigable by a railway from Thiès to Bamako and Kulikoro, except for a section at Ambidedi. That section is now under construction, and when completed next year there will be a continuous line to Kulikoro, with a possible continuation along the Niger valley and a connection with the railways which it is proposed to construct to the Ivory Coast. The railway has a 1 m. gauge, and is the only means of communication with the interior, for neither the Senegal nor the Niger down to Bamako is navigable.



MAP SHOWING FRENCH COLONIES IN WEST AFRICA

In French Guinea also the same idea of reaching the Niger Valley dominated the railway policy of the Colony, and the first project had to be abandoned because the territory through which it would have passed was incorporated in Sierre Leone by a subsequent adjustment of frontiers. It was then decided to build a metre-gauge line from Konakry, which traversed the Futa mountain range and reached Kurussa and was finally extended to Kankan, where it is about 300 kiloms. from Bamako. The length of the line is 660 kiloms. Kankan is situated on the Milo, a navigable tributary of the Niger. As offering the shortest route to the Niger Valley the existing line in the Ivory Coast from Abidjan to Buaké is being extended to Kutiala, a distance of 676 kiloms., and the programme provides for a junction with the Senegal-Niger Railway, which it is proposed to extend along the Niger Valley so that there shall be continuous communication from Thiès, near Dakar, in Senegal, to Abidjan in the Ivory Coast. At the same time it is proposed to build a line from Buaké, the terminus of the existing line in the Ivory Coast, to Uagadugu, to the north of the Gold Coast, which will be continued to join the Togo-Dahomey system. At present the only port in the Ivory Coast is the Grand-Bassam, which is quite incapable of dealing with the future traffic with the Niger, and it is proposed to create a port in the Ebrié lagoon. It is said that this port will be one of the finest in Africa. So far, the total length of railways constructed in French West Africa is 2700 kiloms., in addition to 15,000 kiloms. of roads for the use of motor cars during the greater part of the year. The new programme provides for an expenditure of 1200 million francs upon the construction of 2200 kiloms. of new railway, upon harbour improvements, and on the irrigation of a part of the Niger Valley for the cultivation of cotton, which is to supply the home industry with the whole of its needs.

As the West African railway policy aims at "penetration" to the territories in the bend of the Niger, to the north of the Gold Coast, so efforts are centred almost entirely at the moment in the development of those territories. Experiments for years past having proved that cotton of the best quality can be grown in the Niger Valley with suitable irrigation, a credit of 280 million francs is provided for in the Sarraut programme for the carrying out of irrigation works. The Cotton Association, which conducted the experiments, has been superseded by a powerful syndicate known as the Compagnie Générale des Colonies, in which are interested many of the leading financial houses, and the new company has recently sent out a mission of experts to investigate the methods to be adopted and especially to report upon the project of M. Bélime. The remarkable samples of cotton at the Marseilles Exhibition support the contention that the Niger Valley, with suitable irrigation, is capable of producing cotton of as good quality as that of the valley of the Nile. When M. Bélime undertook his mission in 1919 and 1920 he made a thorough investigation into the geological and meteorological conditions, with reference not only to cotton, but to cereals and other crops and oil-bearing products, and his report is a valuable contribution to literature on the products of the French Sudan. That area appears to have considerable possibilities if the population can be induced to settle in the centres of cultivation. He affirms that the cotton area in the French Sudan alone is about 150,000 square kiloms. The valley of the Niger, from the point where the river is joined by the Bani at Mopti, is subjected to periodical inundations as far as Timbuctoo, and on the upper part of the river from Mopti to Bamako, on the line to Dakar, the territory has to be irrigated for the production of cotton. While dealing with cotton M. Bélime gives special attention to wheat, rice and other cereals, of which the production will be considerably increased by the irrigation works, and he concludes that the construction of a barrage, capable of holding up 1,200,000,000 cubic metres of water, would permit of the Nigerian plains producing their maximum. It is proposed to construct the barrage between Bamako and Siguiri, where the river passes between rocky heights particularly favourable to the building of a dam. From that barrage there would be two canals, one on each side of the river and following the bases of the hills for about 200 kiloms., when they open out, the range on the right bank taking an easterly direction and then following the Bani and the Niger towards Timbuctoo. The Ségou Canal would have a width at water level of 75 m. and a depth of 5 m. Just below Kulikoro a hydro-electric installation might be laid down to supply current for the electrification of the railway to Thiès, on the Dakar-St. Louis line. The head of water would vary from 15.75 m. to 18.55 m., and the power available for distribution would be about 9000 horse-power. To provide against any deficit of hydraulic power during

* No. I. appeared July 28th.

low water a reservoir would be constructed at the point where the tributary Faya joins the Niger. The reservoir would also maintain supplies to the Ségou Canal under the same conditions. A certain number of siphons and aqueducts would have to be constructed, but apart from the cutting of the canals the works would not be of a particularly difficult or costly character. The Ségou Canal would follow more or less the Niger, and beyond the town of Ségou itself another canal would branch off to irrigate the lands in the bend of the Bani. On the left bank of the Niger

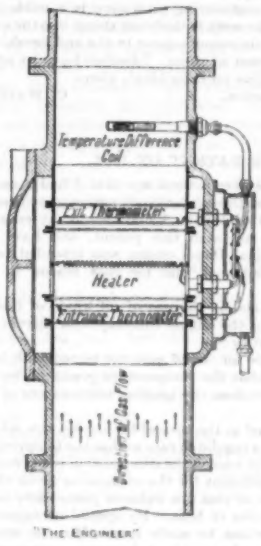


FIG. 1

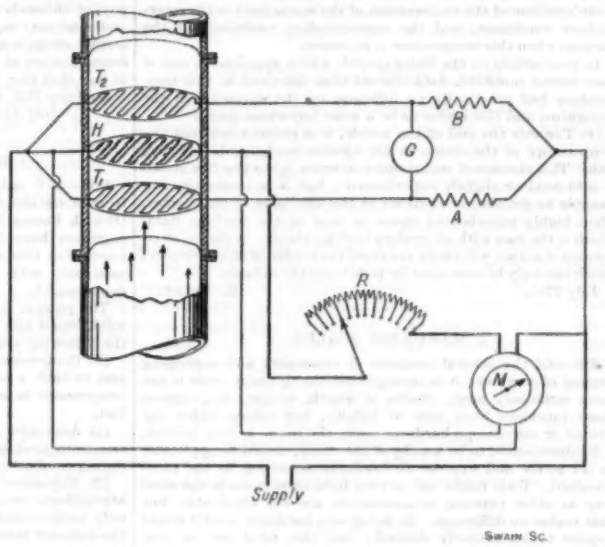


FIG. 2

the Nyamina Canal would start from the same point as the Ségou and follow the rocky range, and another canal would begin at Sansanding and end to the north of Mopti. The total cost of the undertaking is estimated at 262 million francs, which works out at about 350f. per hectare—2½ acres—of land irrigated.

In French Equatorial Africa a certain number of minor public works is to be carried out, but it does not appear as if there is much to be hoped for in the immediate future of this Colony owing to the sparseness of the population and the difficulty of obtaining satisfactory labour results from the natives. On the other hand, steady progress is being made in Madagascar, where the Sarraut programme provides for an expenditure of 300 million francs, of which 185 million francs will be spent upon railway extensions. It is proposed to build 800 kiloms. of new roads and construct ports at Tamatave, Majunga and Diégo. Nearly the whole of the industrial and agricultural activity in Madagascar is centred in the comparatively narrow belt between the central plateau and the east coast, and the new scheme of development aims at utilising the considerably larger area of fertile land to the west of the plateau, where, however, the population is very sparse. This development again can only be accomplished by drainage and irrigation. It is proposed to use for this purpose the Aloatra Lake, which can irrigate a quarter of a million acres of land for the cultivation of cotton, and it is claimed that still more can be done by utilising the numerous small rivers. Madagascar hopes in time to contribute a good share of the cotton required in France. At the same time, all the Colonies are offering suggestions to render the mother country independent of foreign supplies of paper pulp. Algeria undertakes to supply the requirements of alfalfa, and West Africa proposes to meet the demand with papyrus, of which samples were shown at the Marseilles Colonial Exhibition. The exhibits of timber and of a great many other products necessitating the use of machinery proved that, while the public works to be carried out under the Sarraut programme are of interest to the engineer, there is also a growing need in the French Colonies for the engineer's productions.

The Thomas Gas Meter.

A new and interesting form of gas meter has recently been introduced into this country and set to work at certain plants producing gas—town and otherwise. The Thomas meter, as this device is called, has been developed by the Cutler-Hammer Manufacturing Company, of Milwaukee, and is about to be made and sold in this country by the Cambridge and Paul Instrument Company, Limited, 45, Grosvenor-place, S.W. 1. The device is not intended for the ordinary domestic measurement of gas consumption, but for manufacturing plants producing from 25,000 to 2,000,000 cubic feet of gas per hour, or for any other application in which similar volumes of gas or air are dealt with. The smallest meter has a capacity of 25,000 cubic feet, but it is guaranteed to measure down to 2500 cubic feet per hour. Even so, however, the meter is clearly outside ordinary domestic employment.

The principle on which the Thomas meter works is simple, yet ingenious. It consists briefly of measuring the amount of electrical energy required to raise the gas flow 2 deg. Fah. in temperature. The electrical meter is graduated to read directly in terms of cubic feet at standard temperature and pressure. The thermometers are so connected with the source of the electrical energy that should the standard 2 deg. difference of temperature be departed from, the supply of heating current is automatically varied up or down until the 2 deg. difference is restored.

It is obvious that should the gas flow increase, the temperature difference will tend to fall, and if it decreases, the difference will tend to increase. In the one case more and in the other less electrical energy is required to preserve the standard 2 deg. temperature difference, so that the energy consumption is directly proportional to the gas flow. The only proviso is that the specific heat of the gas should remain constant. It has been found, we are informed, that "the quantity of energy required to warm a standard unit of any industrial gas 2 deg. is essentially the same, regardless of variations in composition or the conditions under which the plant is operated." This statement can, of course, only be true within limits, since the specific heats of the constituents of coal and similar gases are not all equal, that of hydrogen, for instance, being round about 3.4 and of carbon monoxide about 0.24. For all practical variations in composition, however, the specific heat of the complete gas may be taken as constant. Although the weight per cubic foot and the specific heat of the various constituents may differ widely, the sum of the products of these two factors, *i.e.*, the heat capacity per cubic foot, is practically a constant figure.

The presence of water vapour in the gas has to be reckoned with, for any variation in its amount will, in view of the relatively high specific heat of steam, have a disproportionate effect on the recorded result. Means, as will be mentioned later, are provided whereby a correction is applied automatically to compensate for any variation in the water vapour content of the gas.

Let it be supposed that the temperature or pressure of the gas reaching the meter varies while the weight of the flow per hour remains unchanged. It is clear that since the weight of the flow remains constant, the energy expended per hour in raising its temperature 2 deg. also remains constant. The indication of the electrical meter is therefore unaltered, and represents the volume of the gas flow in cubic feet per hour as measured at standard temperature and pressure. The meter has thus the valuable feature that it records the flow in standard cubic feet directly, without involving any calculations based on the actual observed average temperature and pressure of the gas.

In this matter, it has to be assumed that the specific heat of the gas being measured is independent of temperature and pressure. Strictly speaking, the specific heats of most gases—hydrogen is an exception—increase with increasing temperature and pressure. Here, again, however, the change occurring consequent upon practical variations of temperature and pressure at a gas plant can presumably be safely neglected.

A section of that portion of the Thomas meter that is embodied in the gas main is given in Fig. 1, and in Fig. 2 this portion with its electrical connections is shown diagrammatically. The entrance and exit thermometers are of the electrical resistance type. Each consists of a nickel wire enclosed within a lead-covered and sealed tube, which completely protects the nickel wire from the corrosive action of the gas. The wire and tube are arranged as a grid filling the whole cross-sectional area of the housing, with the object of averaging the temperature across the flow. The heating unit is disposed between the two thermometers, and is formed of spiral coils of resistance wire stretched across the interior of an insulating ring constituting a part of the housing, and so arranged as to warm the gas uniformly.

The two thermometer resistances form two arms of a Wheatstone bridge, of which the two remaining arms are known resistances A B—Fig. 2. The latter resistances are such that so long as the temperature of the exit thermometer resistance is 2 deg. greater than that of the entrance thermometer the galvanometer G will show no deflection. Should the standard 2 deg. difference be departed from, the galvanometer needle will be deflected, and as a result of the operation of an electrical relay—described later—the resistance R will be automatically adjusted, with a consequent increase or decrease of the energy supplied to the heater H.

In Fig. 3 a view is given of a Thomas meter equipment, having a capacity of 150,000 cubic feet of gas per hour installed at the Gas Light and Coke Company's Shoreditch works. On the left is the housing containing the heater and thermometer resistances. In the middle background is the instrument panel, whereon is fixed an electricity meter indicating the total flow in standard cubic feet, the control galvanometer of the Wheatstone bridge and a graphic recording device indicating the instantaneous value of the flow by means of a pen and chart. The electricity meter does not merely duplicate the chart indications, but performs an integrating function. On the right is the regulator, whereby the heating current is automatically adjusted when the flow changes. It will be understood that in general the regulator will be most conveniently situated near to the heater housing—although close proximity is not essential—but that the instrument panel may be placed in the manager's or engineer's office, or elsewhere, as may be handiest.

The presence of water vapour in the gas, as we have said previously, has to be taken into consideration, because of the relatively high specific heat of steam and the effect on the readings of the variations in the water vapour content which are bound to occur. Moisture or water fog, as distinct from water vapour, if allowed to pass through the meter would, of course, seriously upset the readings, for the latent heat of vaporisation of such moisture would be supplied by the electrical heater and would be falsely recorded as so many cubic feet of gas. Free water is therefore removed by means of a drip pot to the greatest practicable extent, and thereafter what remains is evaporated by passing the gas through a small preheater situated in the main just in front of the meter.

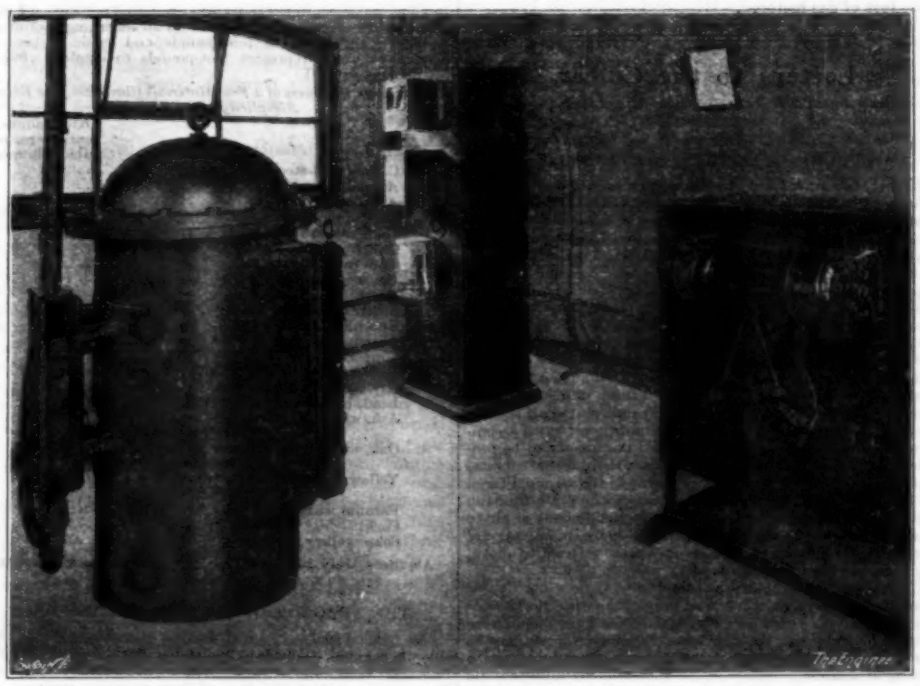


FIG. 3—THOMAS GAS METER PLANT TO MEASURE UP TO 150,000 CUBIC FEET PER HOUR

The gas thus arrives at the meter in a saturated condition, the exact percentage of water vapour present in it being dependent upon the temperature of the gas and also its pressure. The record desired is the hourly flow expressed in standard cubic feet of gas containing that percentage of water vapour which corresponds to saturation at standard pressure and temperature—30in. of mercury and 60 deg. Fah.

To illustrate this point, let us suppose that air at atmospheric pressure is being metered, air being taken because the saturation figures are more readily available for it than for coal or similar gas. Let the temperature of the air arriving at the meter be 80 deg. Fah. As it is saturated, it contains 1.562 lb. of water vapour per 1000 cubic feet. After metering, let the air in the mains fall to standard atmospheric temperature. At 60 deg. Fah. saturated air contains 0.821 lb. of water vapour per 1000 cubic feet. Hence the fall in temperature results in 0.741 lb. of moisture condensing out per 1000 cubic feet. The uncorrected meter reading for the air at 80 deg. would thus be in excess of the true volume of air delivered by an amount corresponding to the volume occupied by 0.741 lb. of water vapour in the air as it passes through the meter.

The necessary correction, if required, is applied to the readings automatically by means of the "temperature difference coil" shown in Fig. 1 above the exit thermometer. This fitting consists of a manganin resistance and a nickel resistance—that is, of two resistances, one of which is substantially constant, and the other of which varies with the temperature. The temperature difference coil and the inlet thermometer resistance are connected in series, and form one arm of the Wheatstone bridge. The total resistance of this arm is thus composed of three parts, one constant, another dependent upon the temperature of the gas arriving at the meter, and the other determined by this temperature plus the temperature rise produced by the heater. The resistance of the other thermometer arm of the bridge is determined by the initial temperature of the gas plus the heater rise. It will be seen, then, that the balance will be upset and the galvanometer show a deflection if the heater rise alters—that is, if the volume of gas flowing through the meter changes. Further, if the initial temperature of the gas changes—the gas always remaining saturated—the temperature difference required to balance the bridge changes automatically from the standard 2 deg. by just the amount necessary to make the wattage consumption per 1000 cubic feet of saturated gas a constant figure regardless of the temperature of the gas passing through the meter.

On the regulator panel—as shown on the right in Fig. 3—there is a motor directly coupled to a dynamo which generates current for the control system. The motor also drives a pair of magnetically controlled pawls oscillating over the face of a ratchet wheel. This ratchet wheel is keyed to a shaft carrying the arm of the regulating resistance R—Fig. 2. At regular intervals the galvanometer needle is clamped between a pair of jaws at the centre of which is an insulated strip. Should the galvanometer needle not be deflected when the clamping takes place, it will make contact with the insulated strip, and nothing farther will happen. Should the needle be deflected, however, the clamping of the jaws will result in a current flowing to one or other of the pawl magnets, with the result that the ratchet wheel and regulator arm will be turned by the motor until sufficient resistance has been cut in or out of the heater circuit to restore the standard 2 deg. temperature rise in the gas flow.

The total consumption of electrical energy by the apparatus, we are informed, is about 12 watts per 1000 cubic feet of gas metered.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

SURFACE CONDENSING PLANT.

Sir,—I have been keenly interested in reading your article on "Surface Condensing Plant," which appeared in The Engineer published on July 21st; but a number of the finer points do not seem to have been fully dealt with, and I should much like to have some explanation, especially with regard to the following:

(1) The steam consumption of the ejector as represented in Fig. 6 varies with the weight of air extracted from the condenser. As this consumption can only vary with the steam pressure, I fail to see what can be the advantage of a device sensitive enough to secure automatic control of this pressure, and at the same time to afford the required amount of safety and reliability. I cannot think that such well-known engineers as the Mirrlees Watson Company would think of regulating the steam pressure by hand, as the slightest unexpected air leakage would bring a heavy fall of vacuum, and in most cases a complete breakdown of the jet—which does not appear to be provided with any stabilising device—unless the pressure is automatically and immediately brought back to the required level. As a matter of fact, reduction of steam consumption by hand adjustment of the pressure, according to the amount of air to be dealt with, can be obtained, as far as I know, in any type of ejector, but because of the serious drawbacks referred to above, engineers have not thought it worth while to do it.

(2) As regards instability of the ejector, it does not appear from the article that what was impossible with the former ejector, without an auxiliary inlet of stabilising air, should have become possible with the new type. Whatever curve may be used for the development of the diffuser, there is always a section of minimum area—*i.e.*, the throat of the diffuser—and consequently the only solutions to the difficulty appear to be:—

(*a*) To calculate the section of the throat for the weight of air in normal working, when any unexpected air leakage will create a considerable fall in vacuum, not only because the weight of air to be dealt with has increased, but because the efficiency of the diffuser decreases very rapidly, through the fact of the velocity of the fluid increasing in proportion to the amount passing through for a given section of the throat. It should be noted that the pressure, and consequently the volume of the fluid at that point depends solely on the pressure at the discharge of the ejector. The fact that the steam communicates its motion to the air only by friction implies that the momentum, and not the kinetic energy, is to be taken into account, so that the slightest increase in velocity of the fluid at the throat will produce a considerable fall in vacuum.

(*b*) To make the section of the throat larger than for normal working, in which case stability at normal load could only be secured by using an excessive amount of steam—so as to compensate for the eddies that become evident in the enlarged section—or by an auxiliary inflow of air in the throat, both of which are detrimental to the efficiency of the jet. The vacua curves in Figs. 5 and 6 cannot be of any use in supporting the above, since, unlike the curves which recently appeared in your columns for another type of ejector, they give insufficient information to enable the efficiency value of the apparatus to be ascertained. These curves seem to refer only to dry air, and in any case the temperature of the saturating vapour is not given, although no air but wet is extracted from a condenser. For this reason, and very rightly in my opinion, engineers have ruled that the acceptance tests for such apparatus must be carried out with saturated air.

(3) Another point which has unfortunately been overlooked is the question of the temperature of the water used in the intermediate condenser, and the corresponding variations in the vacuum when this temperature is increased.

In your article on the Delas ejector, which appeared in one of your recent numbers, data showed that increases in this temperature had practically no influence on the operation of the apparatus, and this seems to be a most important point.

(4) Towards the end of the article, it is pointed out that the temperature of the steam at the ejector discharge is 215 deg. Fah. This statement seems quite in order when the live steam is saturated or slightly superheated; but it is materially impossible to get saturated steam at the discharge of the ejector, when highly superheated steam is used as the working fluid, which is the case with all modern turbine plants. A glance at an entropy diagram will easily convince the reader of this difficulty, which can only be overcome by jacketting the diffuser.

July 27th. R. Velut.

HARDNESS SCALES.

Sir,—Of the several methods of measuring and expressing degrees of hardness, it is strange that the dynamic scale is not more commonly used. Scales of length, weight, &c., express these functions from zero to infinity, but taking either the Brinell or scleroscope hardness scale, the range is very limited. A hardness scale, to be worthy of the name, should be applicable to all solids and express all hardness according to the same standard. Tools might fail on very hard substances in the same way as other extreme measurements are not obtainable, but that makes no difference. In fixing zero hardness, a solid would require to be properly defined; but this need not be considered now.

Regarding the Brinell scale, if we take the standard load as 3000 kilos., we find it is correct only down to about No. 90 hardness. At about that point we have to reduce the load, and the hardness number then obtained is no longer in correct relationship to the numbers obtained with the standard 3000 kilos. load. On most non-metallic substances a very light load would have to be applied, and presumably the results would be still further out of relationship.

With the scleroscope, the hardness scale is beautifully simple, but when we apply the instrument to non-metallic substances it fails at once.

If we now examine the dynamic method of hardness measurement and the dynamic hardness scale, we find it correctly applicable to any solid. On a test piece of uniform hardness, the volume of material displaced by impact is directly proportional to the energy applied. If we state the energy in kilogramme-centimetres and the volume in cubic millimetres, we get a very simple scale, as the subjoined table of hardness of a few metallic and non-metallic materials will show.

The Dynamic Hardness Scale.

In kilogramme-centimetres of energy required to displace 1 cubic millimetre of material by means of an indenting tool of any shape. Expressed in foot-pounds and cubic inches, the numbers would represent foot-pounds to displace .0944in. cube ($^3/_{32}$ nearly).

Approximate Hardness of a Few Materials illustrating the Extreme Simplicity of the Scale.

	Kilogramme-centimetres per cubic millimetre.
Carbon tool steel, dead hard	200
A good second struck file	140
A wagon spring	70
Carbon tool steel from bar	55
High-silicon rail steel	48
Cast iron, good hard	43
Steel rail	38
Boiler plate	25
Brass, hard-drawn	20
Swedish charcoal iron, very pure	17
Gun-metal, average cast	13
Aluminium, cast	9
Copper, soft	8
Vulcanite insulating compound	6
Asphalt road paving	4
Lead, hammered 1.2, soft cast 0.8	1
Ash, well seasoned—End	1.3
Side grain	1.0
Oak, well seasoned—End	0.7
Side grain	0.6
Yellow pine, well seasoned—End	0.3
Side grain	0.1
Paraffin wax candle	0.1
Cork	0.07
Soap, yellow, fairly dry	0.03

Aberdeen, July 25th. R. M. Leslie.

THE TRAGEDY OF THE SMALL ENGINEER.

Sir,—Some years ago I had the idea of purchasing a partnership in a small engineering concern. Accordingly, I applied to several agents who make a speciality of this kind of business. I was soon supplied with lists of firms requiring partners, and I investigated, closely, over a dozen small concerns. Not one of the whole lot was at all attractive. There was little chance of getting anything but the smallest return on my capital, even with my personal labour counted as nothing.

Since this date my work has taken me among many other small concerns in the Midlands, Yorkshire and London. I have usually found the same terrible struggle for existence in all districts. In trying to find the reason for this state of affairs, I have come to the conclusion that failure is due in the main to the following causes:—(1) Capital at start too small; (2) insufficient amount allowed for shop charges; (3) labour of proprietors taken at too law a figure; (4) accepting work at low figures to keep "the wheels turning," with the idea of raising prices later on.

I found that many small shops are largely kept going by the overflow from the bigger concerns. Some of the work could have been done by the larger firms themselves, but they were quick to see that the little men were willing to work for so little, and they accordingly took advantage of it. Even in our present depressed time, the small shop is still being equipped or taken over from some other proprietor, and I venture to say that in at least 75 per cent. of them there will be the same hard struggle. The optimism of these small men is splendid. They are often, too, hard workers and good craftsmen.

Cannot someone try to open the eyes of these enthusiasts to the futility of trying to run manufacturing concerns on too small capital and underestimating prices? Our universities are well equipped for the teaching of the theory of engineering, but they sometimes overlook the fact that we in these days are more "manufacturers" than engineers. What, then, is the use of hard work and deep thinking if it be not directed into paying channels? The engineering profession is a noble one, and some may say that the work is the main thing, but the everlasting struggle of the little manufacturer in the end breaks the courage often of the bravest of them. Idealists have to admit at last that they cannot live on their ideals alone.

Sudbury Hill, near Harrow, July 31st. C. Watts.

DIESEL'S PATENT OF 1892.

Sir,—It is only a little over a week ago that I had occasion to read for the first time Diesel's original patent specification (British Patent No. 7421 of 1892). I find that many eminent engineers have likewise not seen this patent, and have the impression that the original Diesel engine was intended to be used only with pulverised coal, and for that reason it was unsuccessful.

The patent, however, claims the use of all kinds of fuels—solid, liquid and gas—and the engine contemplated therein has the following characteristics:—

(1) Compression of pure air, or of pure air mixed with inert gas, to such a pressure that the temperature produced by the compression is far greater than the ignition temperature of the fuel.

(2) Admission of the fuel at the turn of the stroke, this admission being gradual and at a regulated rate so that the temperature during combustion will not exceed the compression temperature.

(3) Expansion to be sufficient for the exhaust to be at about atmospheric temperature so that the exhaust gases carry away only insignificant quantities of heat. By special arrangement the exhaust temperature can be made lower than the atmospheric temperature and can be used for refrigerating purposes.

(4) No artificial cooling of the cylinder walls is necessary; but, on the contrary, they should be lagged to protect against loss by radiation of heat.

Diesel claims that these characteristics differentiate his engine from all others. Which, if any, of these characteristics are found in the Diesel engine of to-day?

London, July 24th. H. Riall Sankey.

Basin for Submerged Storage of Coal.

Storage of reserve coal under water has been practised for some years by the Great Western Beet Sugar Company, of Denver, U.S.A., as a protection from loss by fire or slow spontaneous combustion. With adequate storage facilities a supply of coal can be accumulated gradually, market conditions offering the main reason for storing large quantities in reserve. The company has several large basins for this purpose, with capacities to suit the requirements of the different factories, their capacities ranging from 8000 to 12,000 tons level full and from 12,000 to 16,000 tons with the coal heaped up above the water level.

A basin for 8750 tons level full, taking coal to weigh 50 lb. per cubic foot, is about 420ft. long and 100ft. wide at the top and 8ft. to 10ft. deep, the bottom having a fall of 2ft. in its length of 398ft. The sides are vertical for 3½ft. from the top and then have a slope of 1½ to 1 to the bottom. The top is 3½ft. above the level of the ground. Along each side runs a line of rails for the railway coal wagons, coal being unloaded from or loaded into the wagons by a locomotive crane with grab bucket.

The floor and sides are of concrete, 10in. thick, formed as a 6in. bottom course and 4in. top course, separated by a waterproofing layer of asphalt. The lower course is reinforced at 3in. from the top by a continuous sheet of wire netting of 4in. triangular mesh. No reinforcement is placed in the upper course.

Transverse joints 15ft. apart are formed in the bottom course of concrete, with longitudinal joints from the last transverse joints to the ends of the basin. These joints are filled with two layers of tar paper. The upper course, however, is divided into slabs 12ft. by 15ft. by means of expansion joints in both directions, the transverse joints being midway between those of the lower course. These expansion joints are ½in. wide on top and ¼in. at the bottom. Their faces are painted with asphalt and then the joints are packed with elaterite. On the sloping sides the tops of the joints are caulked with hemp or oakum to prevent any flow of the packing. The waterproofing layer between the two courses of concrete is ¼in. thick, the surface of the lower slab being first coated with asphalt paint. In order to prevent any possible shifting or creeping of the rectangular slabs each one is secured to the bottom course of concrete by a steel pin 1in. square and 6in. long.

The bottom of the basin is 6ft. narrower at the lower end than at the upper end, the width of slope widening correspondingly, as the top width is the same at both ends. This variation is effected by a tapering row of bottom slabs at the foot of each side slope, the width of each row being 6ft. 9in. at the top and 3ft. 9in. at the bottom.

A drainage chamber 3ft. wide, with vertical sides, is provided in the end slope at the lower end of the basin for the purpose of emptying or unwatering. At this point a horizontal expansion joint is formed between the vertical end wall and the flat floor. In the wall is set a 6in. pipe with asphalted sleeve, the pipe ending in a valve in the chamber. This is a 6in. straight-way valve, operated by a hand wheel. The outer end of the pipe is carried to a sewer.

To prevent the clogging of the valve and pipe by small coal the drainage chamber is covered by a perforated plate screen, 4½ft. by 12½ft., ½in. thick, resting on the inclined end slope. The holes are ½in. diameter and ¼in. pitch.

A Seven-Day Journal.

The Newcomen Society's "Transactions."

THE first volume of the Newcomen Society's "Transactions" has just been published, and is a very attractive production, quite different in appearance from any of the usual somewhat unimaginatively arranged "Proceedings" in which the majority of our institutions and societies record their activities. The volume contains Mr. Hulme's note on the literature of historical engineering to the year 1640, Mr. Rhys Jenkins' interesting and scholarly study of the Sussex iron industry, Mr. Pendred's note on Trevithick's London locomotives, Mr. Seymour-Jones' account of roller drawing in cotton spinning, and Mr. Titley's presidential address. It is issued at the price of 20s., and copies may be obtained on payment of this sum by non-members of the Society from the secretary, Mr. H. W. Dickinson, the Science Museum, South Kensington, S.W. 7.

Disinfecting Liners.

IN the Journal for June 2nd we commented upon the use in the United States of hydrocyanic acid gas—prussic acid gas—for the disinfection of steamships and upon the attempts made to introduce its employment for this purpose into Great Britain. Although this gas is a very effective disinfectant and does not damage furnishings, it is, of course, of a highly poisonous nature. The danger attending its use has been demonstrated before, and has now been painfully emphasised by the fatal accident on board the Mauretania on Sunday night at Southampton, when two experts using the gas were overcome and lost their lives. Failing to make their appearance at the specified time, they were sought for and were found unconscious. Artificial respiration was applied for two hours, but without success, the men dying in hospital soon afterwards. The Ministry of Health, it may be recalled, is now investigating a disinfecting gas which is non-poisonous and which does not damage fabrics, &c., as does hydrocyanic acid gas.

Wireless Broadcasting.

IT is officially stated that no licences have yet been issued in this country to establish wireless broadcasting stations. It is understood that the principal British wireless apparatus makers are about to form a combine for the purpose of providing broadcasting services. The receiving apparatus to be used will be of British manufacture and of a type approved by the broadcasting combine. The revenue of the combine will be derived partly from a contribution from the manufacturers in proportion to the number of receiving sets sold by them, and partly from a proportion of the annual licence fees collected by the Post Office. It has been made clear that amateurs who construct their own receiving sets or licensees who have already purchased imported receiving sets will be permitted to use them.

London's Air Defences.

PLANS for placing the anti-aircraft defences of London on a proper basis are, it seems, now taking definite shape. A short time ago it was announced that the War Office was forming two Air Defence Brigades on a territorial basis to man the ground defences. It is now reported that the Air Ministry is to establish an air defence station at Biggin Hill, Bromley, Kent, where night flying experiments and other work connected with the aerial side of the matter will be carried out. It is added that fifteen machines of Squadron No. 56 will be based on the station in the first instance, the number being increased later on as the system of defence is developed.

Double Reduction Turbine Gearing.

THERE is no gainsaying the fact that double reduction turbine gearing has given unsatisfactory results in a certain small number of vessels and is viewed with suspicion, if not dislike, by some marine engineers. Rapid wear, stripping and excessive noise and vibration are the outward signs of the trouble, the inward cause or causes of which are not yet agreed upon. Some hold that defective material or workmanship is at the root of the trouble, while others maintain that it is the result of synchronisation between the natural period of vibration of the shafts and the speed and number of teeth on the wheels and pinions. The latter view seems to be supported by the complete absence of the trouble in some vessels and its very objectionable presence in others, and by the fact that the introduction of "nodal" drives as described in the papers read at the spring meetings of the Naval Architects by Dr. J. H. Smith and Mr. J. Wilkie, has effected a striking cure in at least one instance. The importance of arriving at a solution of the problem is evident, and it is therefore interesting to note that the Institution of Mechanical Engineers is endeavouring to arrange a general discussion on the subject, to be introduced by about half a dozen short papers by certain authorities. The meeting, it is hoped, will be held about February; but so far, we are informed, the response of manufacturers and users to take part in it has not been very good. We notice in a contemporary a statement to the effect that the shipowners themselves are about to move independently in the matter, and have called conferences of experts thoroughly to discuss the situation.

Mid-Scotland Ship Canal.

RENEWED activity is being manifested by those interested in the promotion of the Mid-Scotland Ship Canal, whereby communication would be provided between the Forth and the Clyde for sea-going vessels by a direct route at sea level. It will be recalled that in his memoirs the late Lord Fisher stated that when he was at the Admiralty he was strongly in favour of such a canal in preference to the establishment of a naval base at Rosyth. It is now being urged that the canal would not only be a profitable work of national importance, but would, in its construction, find employment for many men who are now idle. The Secretary for Scotland is being requested to press upon the Government the desirability of proceeding with the construction of the canal and of obtaining in the first instance an engineering report on the practicability of the scheme. Opinion is yet divided as to whether the canal should run from Grangemouth on the Forth to Yoker on the Clyde, or whether it should take in Loch Lomond at its western end.

An Old Rolling Mill.

THE rolling mills at Winlaton, near Gateshead, established by Sir Ambrose Crowley in 1691, are now being dismantled by Messrs. Raine and Co., of Derwenthaugh. All the furnaces have now disappeared, but the old rolls and other machinery are still in existence. The water-wheel employed in bygone days to drive the machinery is also still in working order, and is being used by the dismantlers to operate the shears used for cutting up the scrap ironwork derived from the works.

Clifden Station Destroyed.

IN the course of their proceedings in South-West Ireland the irregular forces opposing the Government troops last week burned down the Marconi Company's wireless station at Clifden. This, the first large wireless station to be opened, began operations in October, 1907, and was chiefly used for communicating with Canada. As a result of the irregular forces' action, however, communication with Glace Bay, Nova Scotia, was interrupted only for a few hours, the service being resumed from the company's new station at North Weald, Essex, designed normally for the French, Swiss and Spanish services.

Metropolitan Water Board's Coal Consumption.

AT last week's meeting of the Metropolitan Water Board a member expressed great concern about the growth in the Board's consumption of coal. The estimated cost of the coal required during the next twelve months is £308,720 and shows an increase of 10 per cent. per unit of water pumped as compared with the consumption in 1907, representing a total monetary increase of £30,000. It was urged that big manufacturing and other concerns had in the period effected improvements in efficiency representing a decrease on the average of at least 10 per cent. in the coal consumption per unit manufactured or delivered. The Board, it was claimed, was thus suffering an actual loss of at least £60,000 per year by adhering to its existing machinery and methods. It is just possible, however, that the annual charge involved in replacing or bringing the existing plants up to date would, in the prevailing circumstances, more than outweigh any saving obtainable by the installation of plant with improved efficiency. It may perhaps be news to some readers to hear that the Metropolitan Water Board still has in use, or had until quite recently, some pumping sets made by Boulton and Watt.

The Engineers' Ballot.

SUBSEQUENT to the announcement last week of the adverse result of the engineering operatives' ballot on the question of the reduction of the war bonus from 26s. 6d. to 10s. per week in three equal instalments, efforts were made to induce the employers to modify their proposals. The employers replied to the effect that further modification was impossible, and that in the event of their terms being refused they would revert to their original demand for a total reduction of 16s. 6d. in one step almost immediately. In these circumstances, and having regard to the recent lock-out and the number of men still unemployed, the secretaries of the trade unions involved issued a note to their members in which they stated that the unions could not recommend effect being given to the ballot vote. The men were accordingly advised to continue at work and accept the reductions. These reductions, of 5s. 6d. each, will, under the employers' terms, take effect from July 31st, August 28th, and September 25th.

Payment by Results.

IN the terms of settlement of the recent dispute concerning managerial rights in the engineering industry a clause was inserted providing for the discussion of the introduction of systems of payment by results between the employers and such of the unions as had not already accepted such systems. It was agreed by the employers that no system of payment by results, except where already operative, would be put in force during the month immediately following the end of the dispute, and that that period would be used for the purpose of endeavouring to find an agreed basis. Although the discussion of this matter has been affected by the proceedings connected with the reduction of the war bonus, a beginning has been made with it between the employers and, among others, the moulders, patternmakers and boilermakers. Agreement has been reached in some instances. The boilermakers are being balloted on the question and the Amalgamated Engineering Union met the employers on Wednesday to discuss it.

Wireless to Australia.

DIRECT wireless communication with Australia will be possible in the near future. Plans to this end are already so far advanced that a site for the large station in this country required for the purpose has been inspected. The proposed station will probably be situated at Bourne, in Lincolnshire, and will, it is said, be equipped with aerials a mile in length and half a mile in breadth. The total cost of the station will be over a million sterling.

Railway Shopmen's Wages.

THE decision of the Industrial Court regarding the rates of pay and conditions of service of English and Welsh railway shopmen—see the Journal for July 21st—has not been received with pleasure by certain of the craft unions involved in the matter. It will be recalled that the National Union of Railwaymen adopted the view that railway service in all its branches should be regarded as a separate industry, and that wages and conditions should accordingly be fixed by independent standards. The craft unions, however, urged in effect that a boilermaker was a boilermaker whether he were employed in a railway shop or in a shipyard, and therefore that his wages and conditions of work should be the same as those fixed for his fellow-tradesmen in the district by whomsoever employed. Sir William Mackenzie favoured in principle the National Union's view, but recommended rates of pay which did not differ widely from established district rates. The craft unions are now objecting on the ground that even as it is Sir William's decision is far too much on the basis of regarding railway service as a separate industry. They consider that the decision discriminates unreasonably as between the different railway centres and think its grading of semi-skilled labour unjust. At the root of their objections, however, probably lies the fact that the award requires them to co-operate with the National Union of Railwaymen to the extent of setting up joint machinery to carry it out.

Black Smoke from Locomotives.

AT the instance of the London County Council, the London, Brighton and South Coast Railway and the South-Eastern and Chatham Railway were summonsed at Greenwich Police Court on Tuesday for permitting certain engines to emit black smoke. The magistrate held that it was not practicable to construct an engine which would entirely consume its own smoke; that there was no obligation upon the railway companies to use the best Welsh coal; that the engines in question were properly constructed; and that there was no default in the matter on the part of the companies or any of their servants. He accordingly dismissed the summonses and allowed the companies five guineas costs.

The Standard Pound and Yard.

THE Parliamentary copies of the Imperial standard pound and yard were recently removed for the purpose of inspection and comparison from their resting place in a staircase wall of the House of Commons. In the presence of the Speaker and the President of the Board of Trade they were yesterday formally re-embedded in their historic position.

Railways in British Malaya.

THE Federated Malay States Railways' system serves not only the Federated Malay States proper but also the Straits Settlements and the Unfederated States of Kedah, Perlis, Kelantan and Johore. Of the 1020 miles of line open for traffic, the Federated Malay States Government owns all but 120 miles running through Johore State. The entire system is operated by the Federated Malay States Railways, the Johore line being leased to it by the Johore Government. The first length of line laid was from Taiping to Port Weld, in Perak, a distance of 8 miles. This line was built by Perak State, and was opened for traffic on June 1st, 1885. In the following year the first line in the State of Selangor was opened from Kuala Lumpur to Klang, a distance of 21¼ miles.

Steady progress was maintained in both states, and in 1901 the first general manager and chief engineer was appointed to control both the Perak and Selangor State Railways. The mileage open for traffic by the end of 1901 had increased to 244, of which 97 were in Selangor and 147 were in Perak. By the end of 1903 the mileage open for traffic had increased to 340, the two systems had been linked up, and through communication was established from Penang in the north to Seremban in Negri Sembilan. It is interesting to recall that the first through passenger train from Perak was one conveying his Highness the Sultan of Perak and suite from Kuala Kangsar to Kuala Lumpur on the occasion of the second and last conference of chiefs of the Federated Malay States.

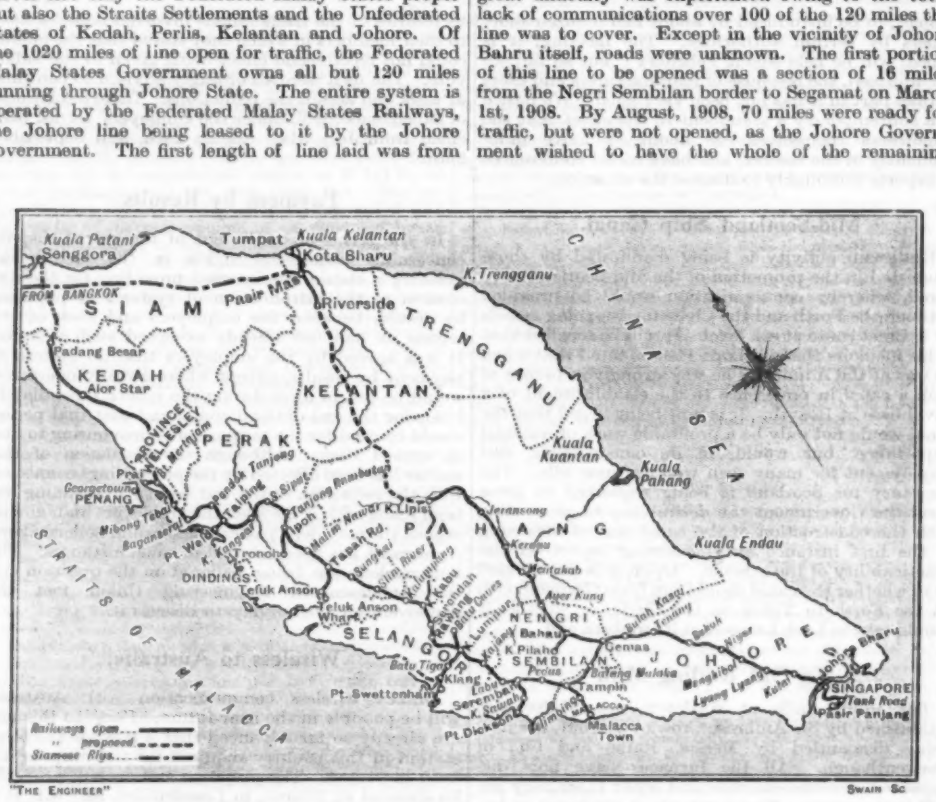
During 1904 the main line was carried further south towards towards Malacca and Johore State. An agreement was also completed with the Government of the latter for the construction of a line from the Federated Malay States frontier to Johore Bahru opposite Singapore Island, and the construction of this line was started from the southern end in December, 1904, and from the northern end in March, 1905. This line ran through jungle for practically its whole length, and when the survey started in March, 1904, great difficulty was experienced owing to the total lack of communications over 100 of the 120 miles the line was to cover. Except in the vicinity of Johore Bahru itself, roads were unknown. The first portion of this line to be opened was a section of 16 miles from the Negri Sembilan border to Segamat on March 1st, 1908. By August, 1908, 70 miles were ready for traffic, but were not opened, as the Johore Government wished to have the whole of the remaining portion of the line opened at the same time. This was done on July 1st, 1909, and through communication was thereby established between Penang in the north and Johore Bahru in the south. Following close upon this came the completion of a wagon ferry across the Straits separating Singapore Island from the mainland, which was put into service on January 1st, 1910.

The Singapore Government had already opened a line in January, 1903, running from Woodlands on the northern shore of Singapore Island to Singapore itself, 19½ miles, and this was purchased by the Federated Malay States Government in 1913. With the inclusion, in 1912, of the Johore State Railway in the Federated Malay States administration, and the extension of the main line through Kedah to Alor Star, the capital of that state, in 1915, and subsequently through Perlis to the Siamese frontier at Padang Besar in March, 1918, the Malay Peninsula found itself with a well-equipped railway worked by one administration, offering transport facilities from end to end of the Peninsula and a service for both goods and passenger traffic, which, it is asserted, is not surpassed by that of any other Colony or Protectorate.

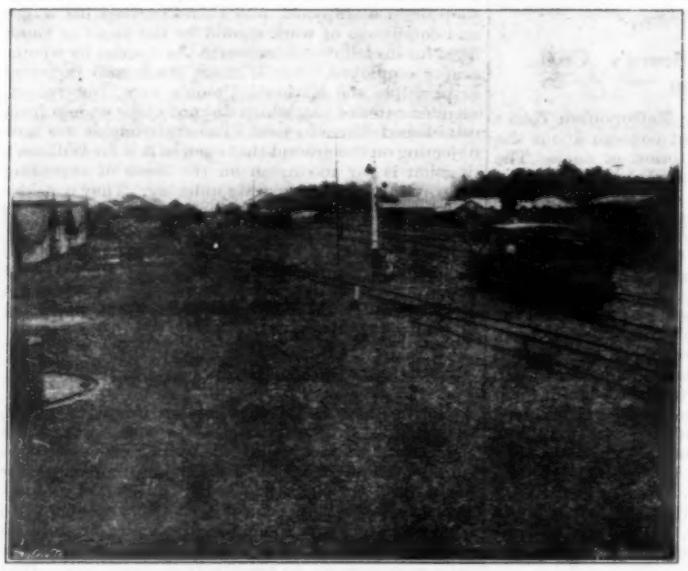
Goods traffic across the Straits from Johore Bahru on the mainland to Singapore Island is carried by wagon ferries, trans-shipment thus being obviated. Passengers are taken over by a passenger launch, but a causeway across the Straits is at present being constructed, and, when that is completed, trains will be run right through to the centre of Singapore itself. In addition to two lines of rails this causeway will also carry a road. The distance across is 3480ft. We referred to this work in our issue of April 30th, 1920, when we pointed out that it was originally intended to construct a bridge to carry the railway, and, in addition, a roadway for ordinary traffic. For various reasons, however, including that of the enhanced cost of materials, it was decided to construct a causeway, which consists of a large bank of granite rubble extending across the Straits from Johore Bahru Station on the mainland to a point about 350ft. north-east of Woodlands on the Singapore side. The total length of the structure is about 3480ft. The bank is situated in a considerable depth of water, the average being 47ft. at low water. It has a width at the top of 60ft., which affords room for a double line of railway, and a 26ft. 6in. roadway for vehicular traffic, which is protected on the outer or water side by a concrete parapet wall, and is divided from the railway by substantial fencing.

As the work when completed will entirely close the Straits, a passageway through the causeway for the use of vessels had to be provided for. It is anticipated that there will be slight differences of the levels of the water on either side of the bank, and provision has been made for a lock with double gates capable of dealing with heads of water on either side of the lock. The latter measures 170ft. between cills, is 32ft. in width and has a depth of 10ft. at low water. The road and railway are carried over the lock by means of an electrically operated rolling lift bridge.

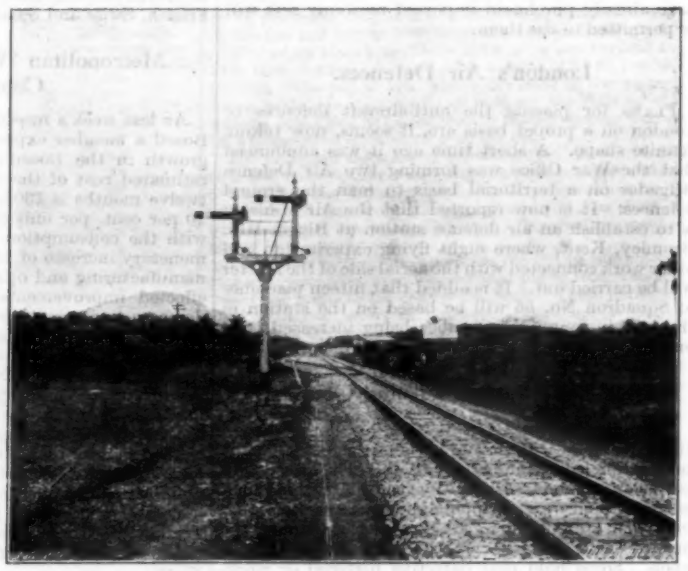
Sight has not been lost of opportunities for linking up coast towns and for opening feeder lines. As far back as 1893 the Port of Teluk Anson in Perak was linked up to the main line at Tapah-road, serving an important rubber-growing and tin-mining centre. The Kinta Valley—the most important tin-mining district in the world—was further tapped by the construction of a line from Ipoh (Perak) to Tronoh, 16 miles, opened in 1905. In Selangor in the same year a branch line was opened to serve the railway workshops, on the outskirts of Kuala Lumpur, and the quarries at Batu Caves, where there are unlimited supplies of road metal. This also is a rubber-growing district. Tin mines at Ampang, near Kuala Lumpur, were supplied with a line constructed in 1914. In the following year an important branch line was opened for traffic from the Malayan Collieries at Batu Arang, joining the main line at Kuang, 7 miles away. This branch has since been extended for 7 miles towards the west coast. Port Swettenham, on the west coast, 5 miles beyond Klang, to which point the first Selangor line was built in 1886, was connected up in January, 1899, and shipping has grown rapidly, since Port Swettenham offered facilities which the older port of Klang, served only by river, could never offer. Ships of the most prominent goods lines trading to the East can be seen here at any time discharging machinery, railway material, foodstuffs and quantities of other articles required for a rapidly developing country, or loading cases of rubber or tin ore, the two principal exports of this peninsula. The wharves admit of ocean-going boats coming alongside, while there is ample accommodation in the roads for boats discharging into tongkangs or lighters. Large warehouses have been constructed close to the wharves for the storage of rubber, rice, &c., and there is a regular service of goods trains to all parts of the peninsula and Siam.



MAP SHOWING RAILWAYS IN THE MALAY PENINSULA



TUMPAT STATION YARD, EAST COAST SECTION



JARAK STATION, KEDAH SECTION

Passenger boats, both local and those trading to Europe, also call at the port, meeting the need of the thickly populated central portion of the peninsula which forms the hinterland. From Klang, a line has also been constructed to serve an important agricultural district along the Selangor coast. This line extends for 30 miles, and was completed in 1914.

In Negri Sembilan and Malacca, branch lines run from Seremban to Port Dickson and from Tampin to the old and historical port of Malacca. The Seremban to Port Dickson line (24¼ miles) originally belonged to a private firm, and was purchased by the Federated Malay States Railway Department and worked by that department from July 28th, 1908. The extension from the main line to Malacca Town was opened for traffic in December, 1905.

A glance at the accompanying map of the Malayan Peninsula will show that the west coast is much more developed than the east, and naturally the first lines were built where most required. The east coast is not at present served by railway, except in the northern portion of the State of Kelantan, where the Federated Malay States' system joins the Siamese State Railways again at Sungei Golok. Southwards through Kelantan a line is being built to run through Pahang and Negri Sembilan and join the west coast line at Gemas on the Negri Sembilan—Johore State boundary. In the north this new line was opened southwards from Tumpat for 32 miles south to Riverside in 1914. At the southern end, 146 miles from Gemas have been completed, and are being operated through the states of Negri Sembilan and Pahang as far as Quala Lipis. This line has one branch serving agricultural districts from Bahau to Kuala Pilah, 13 miles, opened in 1910. The line between Riverside and Kuala Lipis is still under construction. The total length of line opened for traffic at the end of 1921 was 1020 miles, and 53 additional miles were actually under construction. The railway is mostly single line and of metre gauge throughout, corresponding with the Siamese Railways.

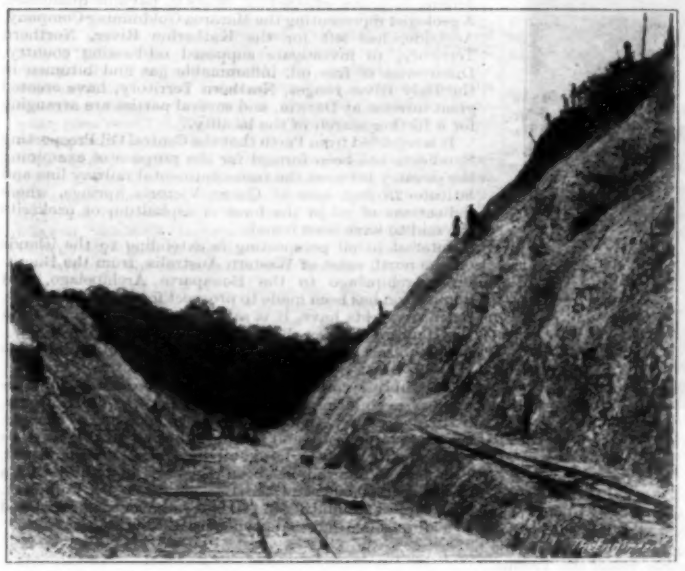
The workshops referred to above near Kuala Lumpur deal with the maintenance and repair of locomotives and rolling stock. Locomotives are usually manufactured in England and erected at the central workshops, but the goods and passenger stock is manufactured there from local timber. These workshops are fully equipped with the modern machinery essential to such an establishment.

Sleeping saloons and dining cars have been running on the night mail trains between Kuala Lumpur and Johore Bahru since 1911. In 1920 similar accommodation was provided on the through trains between Kuala Lumpur and Prai (Penang). Both the sleeping saloons and the dining cars are built at the railway workshops, and will, it is claimed, stand comparison with the stock of any railway in the world. The cabins in the sleeping saloons are roomy, and are furnished with electric light and fans, while each car is fitted with a shower bath. The restaurant cars are likewise electrically lit and have electric fans. The latest development in this direction is the provision of a buffet car, which has recently been completed. At Ipoh and Kuala Lumpur, railway hotels adjoin the stations.

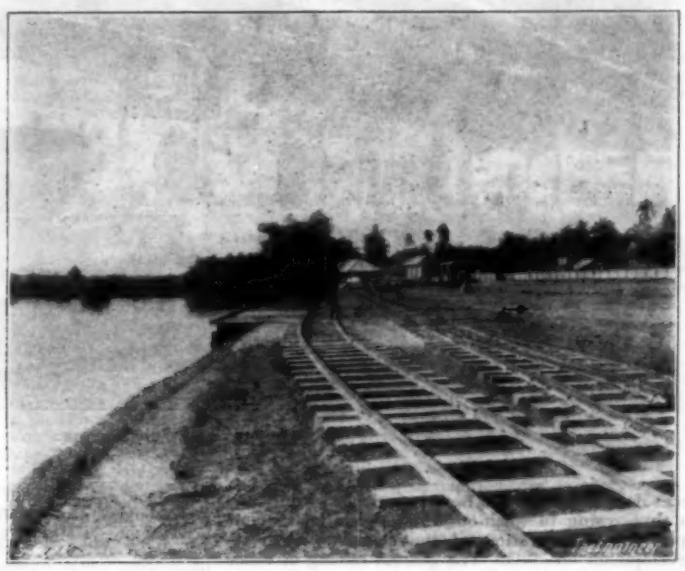
The Federated Malay States Railways are equipped to handle every description of present-day traffic, and, in addition to their own wharves at Port Swettenham, have an extensive scheme on hand for the development of Prai, on the mainland opposite Penang, as a port. We referred to this matter in our issue of April 30th, 1920.

The works consist of (*a*) a reinforced concrete jetty, 1100ft. in length; (*b*) a coal wharf, 900ft. in length; (*c*) the widening and reconstruction of an existing wharf, 600ft. in length; (*d*) a lighter basin with 16ft. depth at low water for small vessels; (*e*) the dredging of the channel and approaches to a width of 500ft. and a depth of 30ft. below low water; and (*f*) the reclamation of adjacent swamps and foreshore to the extent of 170 acres. Of the foregoing, the first is, perhaps, the most important and interesting. The jetty, which extends seawards from the end of the old wharf, is built on rows of concrete cylinders, seven in each row, spaced 25ft. apart longitudinally and 22ft. apart transversely. It has a total width of 142ft., the coping level being 4ft. above high water of ordinary spring tides. The cylinders are built up in rings in a blockyard and are allowed to mature for three months before being used. The rings weigh from 10 to 14 tons each, and require special plant for handling and setting them. Each cylinder has for its base a cutting edge ring 3ft. 6in. in depth, 11ft. 6in. in external and 9ft. 4in. in internal diameter. On the top of the ring is a further ring, which tapers from 11ft. 6in. to 8ft. 6in. in external diameter and to 5ft. in internal diameter. The top of the latter ring is castellated, something after the fashion of a dog clutch, so as to fit into and key with a ring of the same dimensions as those just quoted, 5ft. deep, which is similarly castellated both top and bottom so as not only to key with the cutting ring member, but with a similar ring placed immediately above it. The required length of cylinder is made up by adding a succession of exactly similar rings up to 1ft. 6in. or so below low water. A final compensating ring, made to ascertained dimensions, then brings the top of the cylinder to the required level, and on the top is then placed a special cap, which is capable of slight adjustment in alignment, and which brings the total height up to 2ft. above low water level. A reinforced concrete superstructure for the deck of the jetty is built on the tops of the caps.

The cylinders are sunk in steel guide sleeves, which are fixed to a temporary staging, by grabbing out the mud from the hole in the centre and causing the cylinders to sink by adding cast iron kentledge rings, weighing 5 tons each, as required until the required depth has been reached. A test load of 100 tons of kentledge, in addition to the weight of the concrete cylinder, was then applied, and no cylinder was passed as satisfactory until it had stood forty-eight hours without settlement under the total load, which is equivalent to 5 tons per square foot, and considerably greater than the ultimate load to be borne by the foundations. A good idea of the undertaking

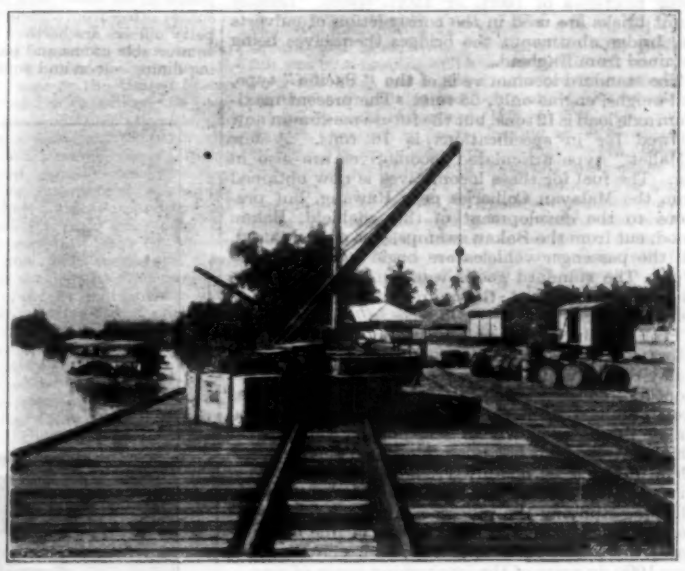


CUTTING AT MILE 123, PAHANG SECTION



KOTA BHARU WHARF, KELANTAN SECTION

SUNGEI KULIM BRIDGE, KEDAH SECTION



LANDING STAGE AND WHARF AT KOTA BHARU

is afforded by the illustrations given on page 118.

At the beginning of this year a through fast weekly service was inaugurated between Penang and Bangkok in Siam, bringing the latter town within thirty-four hours of Penang and within sixty hours of Singapore. This service has been so successful that it is more than probable that it will be run twice a week in the near future.

The permanent way is composed of flat-footed rails spiked on to hardwood sleepers. The standard weight of rail for trunk lines is 80 lb. to the yard, and for the less important lines 60 lb. to the yard, both of British standard section. Throughout practically its whole length the track is ballasted with stone ballast. A great deal of trouble has been experienced from time to time owing to wash-outs and floods consequent upon the deforestation of the country which its development entailed. The general raising of other areas from silt from tin mines has also necessitated a systematic raising of the line and bridges in order to keep above flood level. There are no remarkable bridges in the country, such long bridges as there are being multiples of 100ft. or 150ft. spans. Locally burnt bricks are used in the construction of culverts and bridge abutments, the bridges themselves being obtained from England.

The standard locomotive is of the "Pacific" type, and weighs, engine only, 55 tons. The present maximum axle load is 12 tons, but the future maximum now allowed for in specifications is 16 tons. A few "Mallet" type articulated locomotives are also in use. The fuel for these locomotives is now obtained from the Malayan Collieries near Rawang, but previous to the development of this coalfield, Bakau wood, cut from the Bakau swamps, was entirely used. All the passenger vehicles are bogie stock, corridor type. The standard goods wagon is a 10-ton four-wheeled vehicle, but there are, of course, special vehicles in use.

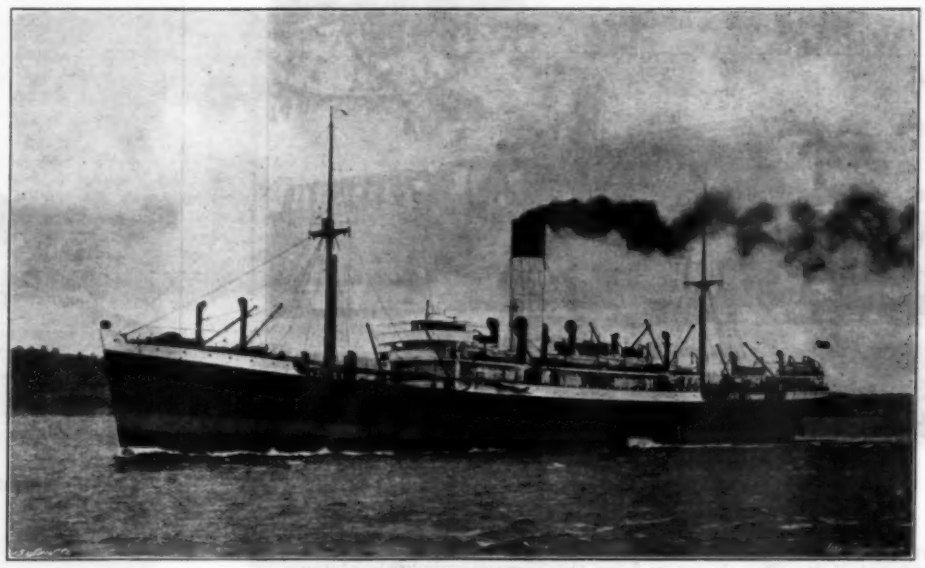
Probably in no other country in the world has railway development been so rapid as in the Federated Malay States, and a most remarkable fact is that the money to construct this fine system of railways has been obtained from the revenues of the Federated Malay States as a whole. As showing the rate at which development has taken place, we may say that when in our issue of July 11th, 1913, we published an article on the subject by a special commissioner who was studying the progress of engineering in the East on our behalf, the total length of line open for traffic was about 700. It is now, as we have shown, over 1000, in spite of the intervening years of war.

KUALA LUMPUR RAILWAY STATION

THE condition of a Californian water-power plant tunnel, which had been in service for thirty-one years, and was then shut down for enlargement, is described in the *Engineering News-Record* as follows:—The tunnel had been driven very close to the surface, and had eight adits in its length of 8300ft. The ground being mostly a very poor grade of granite and very blocky, at places nothing but slides of rock and earth were encountered. The sides and floor were lined with concrete and the roof arched where the ground required it. Only one cave-in was found, it being the only wet place in the roof. The walls had been laid up dry and faced with hand-placed plaster, and the floor had been poured 2in. deep on top of the ties and muck. The latter was about 50 per cent. washed out, but the walls as a whole were in excellent condition. Some slabs from the floor were turned up on edge and obstructed the flow materially. The redwood timbering was concreted in, and being within 2in. of the surface of the concrete, had caused failure in one place. There was no serious amount of moss clinging to the concrete. Through one adit it was possible to crawl into an underground chamber over the tunnel, about 200ft. long and 5ft. high, formed by the arching of the loose rock and earth over the concrete roof of the tunnel. This chamber had been formed during the excavation of the tunnel by the fine dirt sifting down through the lagging.

Shipbuilding Progress at Hong Kong

DURING the last few years some notable vessels have been launched from the shipyards on the China Coast, and there has been a marked tendency for yards—both Chinese and European controlled—to increase their facilities for the building of larger ships. At the end of June the Taikoo Dockyard and Engineering Company, of Hong Kong, Limited—the general managers of which are John Swire and Sons, Limited, of 8, Billiter-square, London, E.C. 3—launched the Rhexenor, a single-screw passenger and cargo steamer, built to the order of Alfred Holt and Co., of Liverpool, which ship is the largest ever built in Hong Kong. The leading dimensions of the Rhexenor are:—Overall length, 476ft.; breadth, 58ft.; and moulded depth, 35ft. 3in.; and about 10,000 tons deadweight. The general appearance of the ship when completed may be gathered from the accompanying illustration, which represents her sister vessel the Troilus. The vessel has six large holds arranged for the carriage of general cargo, and these holds are each served by three steam winches and derricks—eighteen in all—which are designed to deal with loads up to 45 tons weight. The pillars in the holds have been arranged so as to render the spaces as free from obstruction as possible. The officers and petty officers are berthed in large deck-houses amidships, comfortable rooms and passenger accommodation, including dining saloon and smoke room, also being provided in that part of the ship, whilst the seamen are accommodated in the poop.



THE STEAMSHIP TROILUS

The propelling machinery consists of one set of Parsons turbines driving the propeller through double reduction gearing and capable of developing about 6000 shaft horse-power, the machinery and boilers being amply rated for a service speed of 14½ knots.

SEARCH FOR OIL IN AUSTRALIA.

A DEPUTATION from the Association of Oil Licensees recently waited upon the Commonwealth Minister of Home and Territories, Senator Pearce, and requested that the Government should secure the services of a highly qualified geologist and dispatch him to the Northern Territory to report as to the possibility of the discovery of oil there. It was pointed out to the Minister that oil licensees are placed in a difficult position owing to the absence of geological information respecting the territory. Senator Pearce, in reply, said that a number of geological reports on certain parts of the territory was already available, and he pointed out to the deputation that the principal condition of the issue of a licence for an area believed to be oil-bearing was that the licensee shall engage in the search for oil over the area covered by the licence. He did not feel justified in recommending that the Government should send a geologist into the Northern Territory unless he had evidence which would justify that action. He suggested action by the licensees, either individually or collectively, to prospect for the discovery of oil indications.

Meanwhile the Victorian Government Petrologist, Mr. D. J. Mahony, who was employed by the Okes Durack Kimberley Oil Company, to report on the possibility of finding payable oil on the property, which covers 31,400 square miles in the Kimberley division of Western Australia, has reported that there is every justification for drilling, and every hope of success. He states that the source of the oil which has given rise to bitumen has been traced to a particular set of beds, and it now remains for drilling to prove whether oil exists in payable quantities. A geologist representing the Mararoa Goldmining Company, Adelaide, has left for the Katherine River, Northern Territory, to investigate supposed oil-bearing country. Discoveries of free oil, inflammable gas and bitumen in the Daly River ranges, Northern Territory, have created great interest at Darwin, and several parties are arranging for a further search in the locality.

It is reported from Perth that the Central Oil Prospecting Syndicate has been formed for the purpose of examining the country between the transcontinental railway line and latitute 28 deg. east of Queen Victoria Springs, where indications of oil in the form of asphaltum or ozokerite are said to have been found.

Interest in oil prospecting is extending to the islands off the north coast of Western Australia, from the Buccaneer Archipelago to the Bonaparte Archipelago, and application has been made to prospect for oil in the islands. Promising tests have, it is said, been made of shale from the Bairami-Widden shale oil field, near Mudgee, N.S.W., and inquiries are being made with a view of sending the shale to Great Britain.

Test boring conducted in the Latrobe district of Tasmania has confirmed the opinion of Captain de Hautpick, a Russian expert, that there is every evidence of the presence of an oil basin, and that deep boring on a point to be selected will produce liquid oil in commercial quantities. Petroleums, Limited, has been registered in Sydney with a capital of £50,000, and the Barigan Shale Oil Company, with capital amounting to £60,000, has also been registered to acquire shale and coal properties in New South Wales.

BREAKING DOWN SURPLUS AMMUNITION.

IN the early part of 1920, Messrs. George Cohen, Sons and Co. negotiated a contract with the Ministry of Munitions, and undertook to break down all the surplus ammunition in Great Britain. This amounts to approximately 500,000 tons, and consists of all classes of material, including high-explosive shells from 15in., weighing three-quarters of a ton, down to the small pom-poms, weighing 1 lb., aerial bombs weighing 1600 lb., millions of hand grenades, and gas shells. All this ammunition has to be rendered innoxious; chemicals have to be recovered in some cases, and the steel shells have to be made absolutely free from chemicals and explosives, so as to make them suitable for the steel furnaces. Factories had to be built and equipped at Farlington, near Portsmouth; Gainsborough, Pembrey, Banbury and Creden Hill. At present, upwards of 3000 men are employed on the work, and to date over 135,000 tons of ammunition has been completely broken down, and the material consumed by the steel works and brass foundries in the country. The Disposal and Liquidation Commission has now entrusted the firm with a further contract, and an arrangement has been made whereby it is to undertake the clearance of the whole of the empty shells and shrapnel which has been thrown up for disposal, also all the arisings from the Government depôts during the next six months.

Railway Matters.

THE New Zealand Government has appointed a Commission to inquire into the question of constructing a railway line from Taupo to Rotorua, in the middle of the North Island, a distance of approximately 60 miles.

THE death is announced of Mr. Robert Worthington, of Dublin, who built many of the Irish light railways under the Acts of 1883 and 1886. Mr. Worthington was, perhaps, better known for his advocacy of the "Galway as a Transatlantic Port" scheme.

THE *London Gazette* of Friday last announced that Major A. H. L. Mount, late R.E., retires on retired pay on July 29th, and is granted the rank of Lieutenant-Colonel. Colonel Mount is one of the inspecting officers of the Railway Department of the Ministry of Transport.

WE regret to hear of the death on the 25th ultimo, after a long illness, of Colonel E. Druitt, who, from September, 1900, to February, 1919, was one of the inspecting officers of the Railway Department of the Board of Trade. Among the important accidents he inquired into were the Quintinshill of May, 1915, Weedon of August, 1915, and Wigan of December, 1916.

THE Railway Amalgamation Tribunal approved on July 17th a scheme for the distribution of the £500,000 due to the "railways leased and worked" under the Railways Act. The unfortunate East London line, the electrification of which was in progress during the basic year, receives £133,367 of this, which will give some relief to its patient shareholders.

IN order to deal in the best manner possible with the coal traffic during the present coal dispute in the United States a state of emergency has been declared and certain railways are controlled by the Inter-State Commerce Commission. It is of importance to note that the strike of railway shopmen is due to the latter refusing to accept the award of the Railway Labour Board.

WE regret to hear that just as Mr. A. S. Baldwin, the vice-president of the Illinois Central Railroad, was reaching home after his visit to the Rome International Railway Congress he died suddenly as the train was approaching Detroit. The Illinois Central is preparing a big plan for the enlargement of its Chicago termini and for the electrification of the suburban lines, and Mr. Baldwin remained in Europe for some time after the Rome meeting studying the electrification installations there.

THE French railways are, under a Ministerial degree, being equipped with cab signals whereby a whistle is blown when an engine passes over a ramp—called a crocodile—in the "four-foot" should the distant signal be at "danger." This is not automatic train control, as the brake is not interfered with. From a statement made recently by M. le Trocquer, the Minister of Public Works, this work will very shortly be completed. He also said that all passenger carriages will soon be lighted by electricity.

THE London and South-Western Company has arranged to absorb the Lynton and Barnstaple Railway. This action is not a consequence of the Railways Act, 1921, nor, directly, a stage in the grouping of the southern railways, as the Lynton and Barnstaple is a narrow-gauge railway and, therefore, outside the Act. It runs from the Barnstaple station—which is jointly owned by it and the London and South-Western Railway—to Lynton, a distance of 19 miles 15 chains, has four tank engines, 17 carriages, 24 wagons, and is of the 2ft. gauge.

THE interim dividends recently declared by British railway companies have invariably been higher than those declared a year ago. This does not, however, indicate that the railway situation is that much better, but is due solely to the fact that, in view of the uncertainty of the position—the Railways Bill not having then been passed—the companies kept on the safe side by declaring a dividend less than in the summer of 1920. The interim dividends now declared are, in nearly every case, the same as in July, 1920, when the railways were controlled, and that is a significant fact.

ON the 19th ultimo Mr. J. H. Thomas asked a question in the House of Commons as to fatal accidents to permanent way men. Mr. Neal, in reply, said that no opportunity had been or would be omitted by his department of impressing on the railway companies the necessity for taking steps to secure that gangs working on the permanent way were enabled to obtain protection by the appointment of look-out men. There had, he said, been a marked reduction in the number of fatal accidents of that character; the average number for the four years 1911–1914 was eighty, and for the last three and a-half years it was fifty-two.

LAST September two of the three arbitrators appointed to consider the question adjudged that the holders of £37,000,000 of preference and ordinary shares in the Grand Trunk Railway were not entitled to share in the money received from the Government for the purchase of the railway. The arbitrator dissenting was Mr. Taft, our recent visitor from the United States, who represented the shareholders. The railway company carried the case to the Judicial Committee of the Privy Council, where, on the 28th ultimo, it was unanimously dismissed. The only hope for these shareholders is that the Government will give them some compassionate consideration.

A BUFFER stop collision occurred on the morning of Thursday, the 27th ultimo, at Liverpool-street Station, Great Eastern Railway. Such collisions are remarkably rare, considering how frequently the relative operation is made. During the last twenty years there have been, according to the railway accident returns, 241 due to trains entering stations at too high a speed, and 478 due other causes. It is remarkable, though, that the latter increased in number during the ten years 1912–1921, whilst the former had a decrease. For the first ten years there were 144 due to high speed and 174 to other causes; for the second ten years the figures were 97 and 304 respectively. From the evidence given before Major Hall at the Ministry of Transport inquiry on Wednesday last, it was clear that the driver made an error of judgment. He thought he was going to stop short, so released his brake and re-applied it too late.

Notes and Memoranda.

WE hear that a proposal is on foot to form an Association of Manufacturers of Non-corrodible and Anti-Corrosive Products with the object of creating new and increased demands for the products and processes of its members.

ACCORDING to the latest report on the working of the Shanghai municipal electricity supply, the load factor on the plant is as high as 46.7 per cent., which compares with 25.54 at Glasgow, where the total units sold, per annum, is approximately the same as at Shanghai.

A NEW reversible electric motor developing 18,000 horsepower, built by the Société des Ateliers de Constructions Electriques de Charleroi, and intended for the operation of a large blooming mill, has lately been put in operation at the works of the Société des Forges de la Providence, at Charleroi.

IN commenting on a recent mishap in one of the New York subways, the *Engineering News-Record* asks:—"Why is it usually so difficult to obtain information as to the cause of delay in almost every department of transportation service? Much of the danger of panic under such conditions can be averted if those affected are generally informed as to the cause of the delay or difficulty."

A COMMITTEE on Gauging Rivers and Tidal Currents was appointed some time ago to prepare a conspectus of information available as to the methods and appliances which have been used in investigations bearing upon measurements of river flow or of tidal and other currents, and as to the arrangements for the testing and standardising of such apparatus. A report has now been prepared by Dr. M. A. Hogan on the instructions of the Committee, and brings together in a summarised form the information available as to the conditiins affecting the design and use of current meters, and gives a description of those types now in use. The report is issued by the Department of Scientific and Industrial Research, of 16, Queen-street, Westminster, S.W. 1.

A NEW technical school is being established in Calcutta with the aid of a subsidy from the Indian Government. Towards the end of 1919 a committee was appointed by the Bengal Government to advise on the establishment of a technical school in Calcutta, the primary function of which would be to provide part-time technical classes for apprentices employed in the various workshops of the district. As a result of the committee's recommendations, a piece of land about six bighas in area in a central site in Calcutta has been purchased at a cost of about eight lakhs of rupees as the site for the erection of a school building. The acquisition of the land is almost complete. The Government has sanctioned in the budget for 1921–22 an allotment of Rs. 125,000 towards the erection of the ground floor of the school building, which will eventually consist of three floors. The building will be so arranged that the ground floor can be used as a school pending the completion of the two upper floors. Each floor will provide accommodation for an actual attendance of about 300 apprentices. The site is large enough to admit of additional buildings when required.

IN the course of his annual report to the Shanghai Municipal Council, Mr. T. H. U. Aldridge, engineer in chief, remarks that his recent visit to the United States and England not only simplified but expedited the issue specifications, receipt of tenders, and their selection. It was of great advantage, he says, being able to personally meet the representatives of the various manufacturing firms which tendered. The most comprehensive specification which it is possible to draw up cannot always supply the full information, or the whole purpose underlying the scheme which a conference rarely fails to bring out. By more openly taking manufacturers into one's confidence, and making them feel what one really requires of their products; what conditions of service their machines or apparatus will have to operate under; and to listen with an unbiassed ear to objections they may feel compelled to offer regarding certain conditions in the published specifications one issues, tends, in his opinion, to create a better atmosphere of mutual trust and obligation between manufacturer and purchaser, an atmosphere that has, generally speaking, not always been too manifest in the past, but which ought, for the betterment of the engineering industry as a whole, to be fostered by all concerned.

THE Deputy Chief Telegraph Engineer of the Dominion of New Zealand writes to the *Post Office Electrical Engineers' Journal* on the telegraph, telephone, and wireless interferences experienced during a brilliant display of aurora in May last year, and states that they were of greater magnitude and more far-reaching in their effects than any of which the New Zealand Telegraph Department has record. It is the first time, also, that the effect of the aurora upon wireless communication in this, or probably any other, country has been so noticeable. An interesting experiment was performed at Awarua, where, during the height of the disturbance, an insulated counterpoise (or network of insulated wires) was substituted for the usual earth connection. In effect, the wireless receiving system was entirely disconnected from the earth, and therefore not subject to direct interference from electrical charges circulating therein. This removal of the earth connection did not, however, in any way affect the prevailing variations of the signals, which continued to be as erratic as ever. During the period referred to there were brief intervals at all New Zealand stations when signals returned to normal and nothing unusual was noticed. The effects at New Zealand stations may be summarised as follows: (1) Great and sudden variations in signal strength from maximum to minimum; (2) signals from different directions not simultaneously affected; (3) dead periods when neither signals nor statics were heard; (4) period of abnormal intensity of signals and statics; (5) signals from European long-wave stations unaffected during the whole period. All of the New Zealand stations are connected by land telegraph lines with the telegraph centres, and it was noticed at times that great variations in radio signals were simultaneously accompanied by earth currents in the land telegraph lines of sufficient intensity to render the Morse circuits inoperative.

Miscellanea.

THE Government of South Africa is reserving £500,000 of the forthcoming loan estimates for the purpose of a comprehensive scheme of telephone extension.

THE Bengal Legislative Council is proposing to expend Rs. 14,850 on a hydro-electric survey of the country, which, it is expected, will occupy six months to complete.

A COMMISSION has been given to Sir George Buchanan, by the Government of the Union of South Africa, to prepare a scheme for the construction of a harbour, with coal-handling plant, on the north Zululand coast.

THE use wireless might be put to in coal mines was demonstrated in the Blue John Mine, Castleton, Derbyshire, on July 16th by members of the Sheffield Wireless Society. From a depth of about 300ft. they succeeded in sending a message to Hope, about 3 miles away.

AVIATION in Denmark during the year March, 1921–1922, was limited to local flights, and the Danske Luftfarts Selskab will probably, in default of a Government subsidy, be unable to recommence flights on the Danish part of the route from Copenhagen *vid* Hamburg and Holland to the United Kingdom. Work on the large aerodrome near Copenhagen is, however, being continued.

A NEW testing machine for compression and bending, is being installed by Averys in the engineering laboratory, at Armstrong College, Newcastle-on-Tyne. This machine is capable of dealing with columns 10ft. in length and beams of 9ft. span, with a maximum width of 4ft. This width is one of the unique features of the machine, as in previous testing appliances the width has been restricted to a few inches, and in consequence broad flange or T beams, as used in reinforced concrete construction, could not be satisfactorily tested. The maximum load of 120,000 lb. is obtained by hydraulic power and the measurement of the load is made by means of a steelyard which is graduated to read in steps of 25 lb. It is hoped that this new plant will be available for demonstrating at the next opening day of the Armstrong College.

IN the supplementary Budget demands which will come before the next meeting of the Bengal Legislative Council for consideration, there is a proposed provision of money for the installation of four tube wells, each with engine and pump, for irrigation purposes. The policy of the Government is outlined in the following remark: "For some time past experiments have been made with tube wells for irrigation purposes with good results. The Board of the Agricultural Department, at a recent meeting, considered that tube wells might be used as a proper means of irrigation. In Bengal the Hooghly-Burdwan area on the right bank of the Hooghly River, the high land area in the Presidency Division, and the red laterite tract of the Dacca-Mymensingh area, which need irrigation, appear to be suitable for tube wells. It is, therefore, proposed to sink the tube wells at the Dacca, Chinsura and Berhampore farms for experimental purposes."

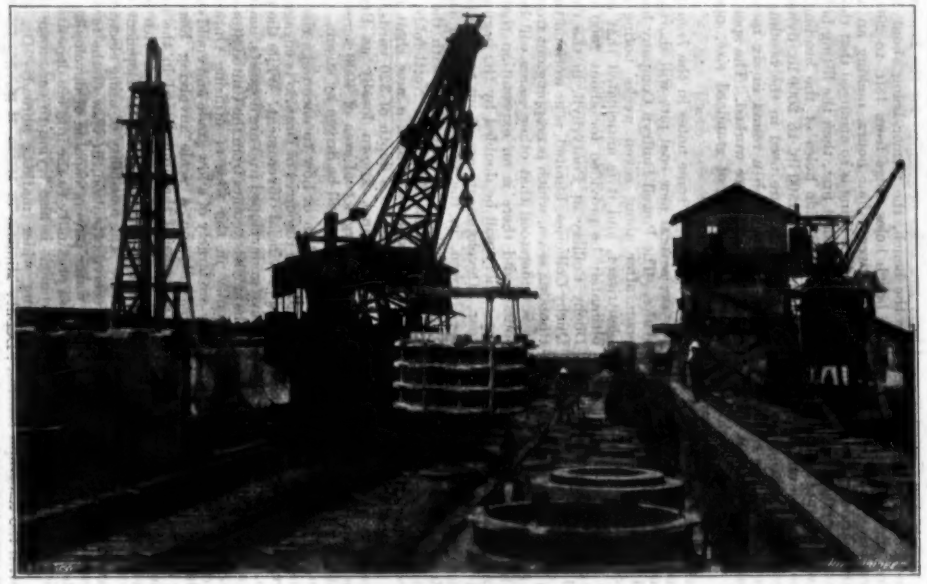
A RECORD in hard rock tunnelling is said to have been made in America during March, when the Big Creek tunnel of the Southern Californian Edison Company was advanced 476ft. during the month. The tunnel is 21ft. square, and is excavated in extremely hard granite to full size by a heading and a short bench. On the average forty-two holes are drilled for the heading and eighteen for the bench, the former being about 18ft. deep, while the bench holes range from 18ft. to 20ft. One round is shot in twenty-four hours, making an advance of 12ft. to 17ft. The firing is so arranged that the cut holes of the heading are shot first, then the lifting holes of the bench, and last the side holes of the heading. The explosive consumption is 1500 lb. to 2000 lb. dynamite per round. Eight machines are used in the heading and six in the bench. They finish a round in six to ten hours. Two eighty-man shifts are worked. The spoil is cleared away by steam shovels of standard size, operated by compressed air.

ACCORDING to some notes in the *Iron and Coal Trades Review*, several new coal pits will shortly be working in Wales. The Powell Duffryn Company has struck the 5ft. seam, after about seven weeks' boring operations, near Llantrisant, and it is anticipated that employment will ultimately be provided for about 2000 miners. At the Duchy Colliery at Pontyrhyll, in the Garw Valley, the Duchy Collieries, Limited, is at work on the 2ft. 6in. No. 2 Rhondda seam, which is cropping out from the mountain. It is understood that other seams will be proved in due course, and there is an expectation that the output of the colliery will be doubled by the beginning of the new year. Developments are about to take place at Gwaun-cae-Gurwen, in the upper reaches of the Amman and Swansea Valleys, in connection with the colliery undertakings of Guest, Keen and Nettlefolds, Limited. The company proposes to sink a new shaft (18ft. diameter) on its property to a depth of 320 yards, in order to tap the lower seams, known locally as Brynllwyd seams, which is a virgin coal area of 4000 acres. All the plant and machinery will be driven by steam.

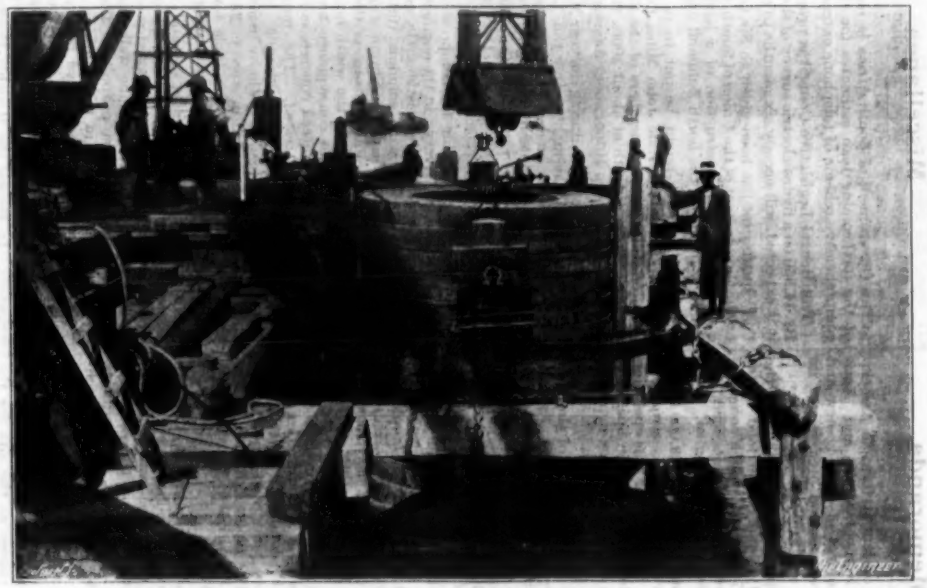
THE problem of how to encourage the development of the iron ore resources of Ontario is engaging the attention of the provincial Government. While the province has extensive undeveloped iron ore deposits, most of the ore used in the smelters comes from the United States. The principal difficulty in the way of utilising Ontario ores is that they are largely of a low grade and could only be exploited successfully on a scale involving heavy expenditure. A conference of those interested in the matter has been called to consider, in conjunction with members of the Government, plans for the development of the iron ore resources. The feasibility of using electricity for smelting will receive attention, in view of the fact that there are large water powers capable of developing electric energy in close proximity to the iron ore deposits. The Canadian Government is also trying to encourage the industry by securing wider markets abroad. Dr. C. C. Carusell, Deputy Minister of Mines, is leaving for England, where he will take the matter up with the Imperial Mineral Resources Bureau. Germany is regarded as presenting favourable opportunities as a market for the iron ores of Newfoundland and the maritime provinces.

FEDERATED MALAY STATES RAILWAYS—NEW JETTY AT PRAI

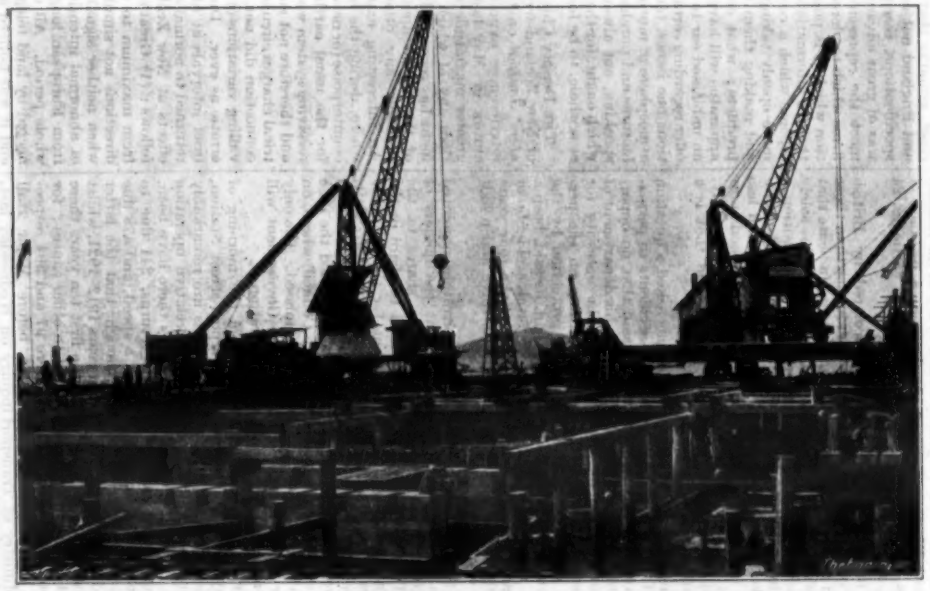
(For description see page 114.)



CYLINDER MAKING YARD



SINKING A CYLINDER



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THE ENGINEER.

AUGUST 4, 1922.

Coming Commercial Competition.

With the American coal strike settled, the British engineers back at work, and German finances straightened out, there will be a great contest for trade—trade in ships, in steel manufactures, and in engineering goods. That contest will be conducted mainly in the pits and the workshops. We shall not win the contest—we shall not obtain enough trade to employ and properly feed ourselves—if we indulge in ca 'canny, if we keep a highly skilled engineer on a simple repetition machine, if we have constant squabbles between employers and workmen about the manning and manipulation of machines, or if we only produce as much coal per man in a week as others produce in a day. We have to face cheap labour competition and subsidised competition. Our competitors have shops full of the best machinery, and it is operated without restriction.

International competition is not a question of low wages per man or per week, but it is a matter of low costs per ton or per article. The nation that can market its goods at the lowest price, consistent with quality, will get the most trade. Not the nation with the cheapest men, but the nation that installs the best machinery and makes the most of such machinery will attain the highest prosperity. It will get the most trade abroad, and it will have the most abundant and cheap goods at home. American industries, for instance, have the cheapest fuel in the world, but American miners get the highest wages. Largely through the employment of mechanical appliances and the willingness of the men to operate such appliances at full capacity, the American output of coal, per unit of labour, is four times as high as the British output. The production of steel in America is three times as high, per man, as in Britain. America, however, is handicapped in the heavy trades by long transport distances, as we will explain later on. German competition is steady, persistent, consistent, highly organised, and it is subsidised. It is plodding and patriotic. German capital is closely syndicated. The German Government carefully nurses trade, and German taxation is always much lower than ours. Industrial Germany labours under some disadvantages, compared with Britain, but she generally gets over them by hard work and careful organisation. For example, German coal and iron supplies are not close together like ours, and most of her works are far inland. The average haulage distance for raw materials to furnaces and for finished goods to ports in Germany is 150 miles. In Britain it is less than 30 miles. Still the Germans compete successfully with us in foreign markets. First, they produce cheaply and on a large scale. Secondly, they "bulk" their goods for shipment, and so get low through rates. Solingen sends out its products in train loads, whilst Sheffield exports its goods in parcels. From one British goods station we have over 9000 separate little consignments in a day. German railways would not handle such paltry traffic. Then, again, in ordinary times the German syndicates bounty-feed their exports, and the State subsidises the ships taking the goods abroad. We can easily measure German competition, and, with our generally better natural resources and very much better shipping facilities, we could comfortably beat Germany in foreign markets if we cared to work anything like so hard, and to organise anything like so well, as the Germans do. Besides, there is trade enough in the world for all of us if we care to work for it. The uncertain factor is American competition. American prices rise and fall and American trade booms and slumps at high speed. But, taking the long and broad view, what are the real competitive conditions? America is easily first in agriculture, in mining and manufacturing productivity, and in internal trade; but when it comes to external commerce, in which we are primarily interested, things are different. In spite of her vast internal resources, America is badly placed for the exportation of iron, steel and heavy engineering products, for the importation of heavy raw materials, and for the building and operation of merchant ships. In the United States the iron ore is deposited one thousand miles from the coal. The bulky stuff has to be carried two trips by rail and a voyage down the Great Lakes by ship, and handled six or seven times before it can be smelted, and for several months in the year the navigation is frozen. The iron and steel works, on account of the situation of the coalfields, are hundreds of miles from tide water. When the works turn out their finished products, these, if for export or shipbuilding, have to be carried between 400 and 500 miles to the coast. America gets a big output per man, and enjoys a high standard of living in consequence. She does an enormous inland trade. She does a big foreign trade in some lines—automobiles and typewriters, for instance. But in the bulky lines—heavy iron, steel and engineering—she has never yet, in any normal time, been able to compete with either Britain or Germany in neutral markets. Her enormous transport distances and costs stand in the way. We, with our convenient assemblage and shipping facilities, can beat America in foreign trade in most lines, even when we produce less than half as much per man as she.

If we produced anything like as much as our rivals per unit of labour, we should beat them all along the line, and enjoy an even higher standard of living than they do. On hard work we can thrive; on indolence we shall perish. In many respects we are the best fitted for the contest. We have our coal and iron supplies, our steel works and shipping ports, all practically side by side. No other country has such a combination of favours. We have an inherent craftsmanship. We have more experience of foreign markets and customs than any other nation. We have the most Colonies to give us preference. We have the most ships to carry our products across the ocean and bring raw materials back. We have a high reputation for sound goods and straight business methods. But we must produce and ship with economy and regularity if we are to prosper. We must not only quote trade-getting prices, but we must guarantee to deliver the goods according to stipulation. We cannot do so if we have a succession of industrial disputes.

Battleships and Aircraft.

On Tuesday last a series of experiments, to which the Admiralty and the Air Ministry evidently attach great importance, was carried out in the Channel, south of the Isle of Wight, the object being to determine the accuracy of bomb practice from aircraft against surface targets—in this case the obsolete battleship Agamemenon and the destroyer Opportune. The bombs used in this experiment were non-destructive. They are officially described as weighing 9 lb., and as being of a new type which, on striking the water or the deck, emits an instantaneous burst of white smoke, but is otherwise innocuous. At the moment of writing, we have no account of the actual proceedings beyond the vague and unofficial reports published in the daily Press, and experience has taught the student of naval matters to be wary in drawing conclusions from data of such character. It has, however, been announced that the trials were primarily arranged

to test the accuracy with which bombs can be dropped on moving targets from heights varying up to 8000ft. They were, according to a *communiqué* issued by the Air Ministry on the 1st inst., in continuation of certain tests which were carried out last year, and it is intended that similar trials shall be effected annually, the purpose being that the cumulative results achieved shall form the basis of the training programme of the recently opened Bombing and Gunnery School. It is hoped, moreover, that they will be valuable in helping to obtain data as to the most suitable methods of attack, the percentage of hits which may be expected, and in testing the efficiency of improved bomb-dropping appliances, both in individual and in formation attacks. It is understood that the two warships which were used as targets were under weigh and that their movements were controlled from a distance by wireless telegraphy.

It is a matter for surprise that more concerning the trials carried out last year has not been made public. For at least three years the partisans of air power have been proclaiming the ascendancy of the aerial bomb in the warfare of the future, by sea even more than on land. Aircraft, they affirm, will constitute such a potent menace to the great ship, whether at sea or in harbour, as to render it practically useless, and on that premise they oppose the contemplated expenditure of £16,000,000 on two additional battleships as waste of money which might be laid out to far better advantage on other means of national defence. In their judgment, it is impossible to design a capital ship which would be reasonably safe from destruction or total disablement by air attack. The Admiralty has not remained passive in face of this challenge to its shipbuilding policy. The case for the battleship has been argued with no lack of vigour by Admiralty spokesmen in Parliament, and notably by the First Lord, whose speech in the Upper House on July 11th was generally understood as being the last word in this controversy from the official side. Its purport was that there had been no new developments in connection with either aerial or underwater attack which could necessitate a reversal of the decision of the Government to proceed with the new ships, or, indeed, any modification in the constructional designs, which had already been approved. "It is," Lord Lee added, "the view of the Admiralty and its military advisers, fortified and based on the experience of the late war, and by a long series of experiments, that it is feasible, both constructionally and financially to build capital ships which shall be reasonably proof against any known or likely methods of attack." It is to be presumed that the "long series of experiments" mentioned by the First Lord refer to the trials mentioned in the Air Ministry's *communiqué*. It is curious, however, that more was not made of them at the time they were carried out. That torpedo-carrying aeroplanes have made several practice attacks on the Fleet is well known, so that allusion may have been made to those exercises. The general public, however, certainly took it as meaning also that actual bombing tests had been made, since in the popular view—which may, of course, be unfounded—the capital ship is in greater danger from heavy bombs than from torpedoes. A similar construction will doubtless have been put upon the assurance given by Mr. Amery in the House of Commons on Wednesday last that "Progressive trials designed to solve all revelant problems . . . have been carried out for some time past and are affording the Director of Naval Construction all necessary information." This statement, it may be explained, was made in reply to a question by Rear-Admiral Sueter, who asked the Parliamentary Secretary to the Admiralty whether he would consider the advisability of the dropping of 3000 lb. to 4000 lb. bombs within 20ft. of one of the battleships detailed to be scrapped under the Washington Conference Agreement, the bomb in each case to be fitted with a delay-action fuse to detonate the explosive charge 30ft. below the surface of the water, and the battleship to be stiffened up below the water line or altered as necessary to comply as nearly as possible with the latest requirements of naval construction for protecting battleships from sub-surface attack. Drastic as such an experment would be, it would not exaggerate the danger to which the battleship may, in future, be exposed, if aircraft and aerial tactics develop as formidably as their champions predict. If it were shown that under Service conditions bombs could be dropped with a reasonable degree of accuracy on or close alongside a moving target by aircraft flying at a considerable height, the demonstration would unquestionably be significant, for the effect of heavy bomb explosions on large surface ships has ceased to be a matter of conjecture since the Ostfriesland trials were held in the United States last summer.

Whether a convincing demonstration of the destructive power of aircraft bombs would justify a reversal of the Admiralty's shipbulding policy, is, however, a different matter altogether. The real issue is not whether such weapons can cause a certain amount of damage, but whether they are likely to produce their maximum effect under war conditions. There would be no real difficulty in sinking the strongest battleship afloat, either by gunfire, bomb or torpedo, if she offered no resistance to attack. That, however, is precisely where war differs so fundamentally from peace experiments. In deciding to build new ships of this type, the Admiralty has certainly taken into consideration the lessons of the late war, which showed how difficult it is, in the excitement and confusion of battle, to utilise any weapon with the precision attainable in peace practice. As we pointed out in a leading article on July 21st both the great gun and the torpedo have for many years threatened the battleship with summary destruction, and each at different times was urged as a reason for abolishing that type of vessel. Nevertheless, war experience showed the danger to have been overrated in both cases, and it is at least arguable that the potency of air attack in naval warfare has been similarly exaggerated. Of one thing we are convinced, and that is that it is not in the best interests of the country that our naval administrators should be forced to modify their considered policy on a technical point in deference to a newspaper agitation. Criticism from those competent to offer it is perfectly justified, but it is only too clear that many persons taking part in the battleship controversy are uninstructed and irresponsible, however good their intentions may be.

Power Signalling on the Melbourne Suburban Railways.

The installation of power and automatic signalling on the Melbourne suburban railways has played no small part in the success that has attended the conversion of the railways from steam to electric traction. This system of signalling has made possible a greatly increased service by providing facilities for a close headway of trains, and at the same time has increased safety, as train stop apparatus is installed in conjunction with the signalling. Furthermore, working expenses have been reduced by the closing of certain signal-boxes, which were previously used principally for block working purposes.

When electrification of the railways was decided upon and the sytem of traction settled, it was immediately obvious that the existing direct-current track circuits, fed from primary batteries, would have to be converted to alternating-current track circuits. The latter type of track circuit had seen rapid development in the United States prior to the decision to electrify the lines, and it was therefore with the fullest confidence that the Railway Administration authorised alternating current to be used entirely for signalling purposes. If no other signalling work were anticipated, the fact that the running rails were to be used for the return propulsion current made it obligatory to adopt alternating-current track circuits with impedance bonds to allow the direct current propulsion return to flow past the insulating block joints.

To make this change and no more would have necessitated the running of mains throughout the sections to be equipped, and the installation of suitable apparatus to take the place of the material displaced, the cost of which would have been great. A certain amount of the annual expenditure on track circuits, would have been saved by the elimination of the primary batteries, but not sufficient to pay the interest charges on the capital cost of mains, transformers, trunking, sub-station equipment and track-circuit apparatus. In any case, the money spent in this direction would not have helped towards better traffic operation, and as the reason for electrifying the lines was the heavy and constant traffic requirements, which were increasing yearly, it was decided to install the most modern system of signalling, and after careful consideration the adoption of three-position, upper-quadrant, speed signalling, together with train-stop devices, was decided upon.

Some Engineering Features.

A separate transmission system is provided for signalling purposes from the different sub-stations on the route at 2200 volts, alternating current, single phase, 25 cycles, and the current is distributed by means of twin conductor cables—with a copper cross section of .015 square inch or .03 square inch, according to circumstances—to track feed boxes, containing two non-automatic and one automatic oil switches, and either one or two 2200/110/6/6-volt transformers of approximately ½ kVA capacity. The transformers are oil immersed and cooled by natural radiation from the case. The track feed boxes are placed near the signals, and 110 volts are used for operating the signal and train-stop mechanisms, whilst the 6-volt winding of the transformer is used for feeding the rails for track-circuiting purposes, and also for signal lighting when the lighting is not controlled from a signal-box. At places where a main track feed box is not available for track circuiting, a 50 VA air-cooled 110/6/6-volt transformer, housed in a small cast iron track feed box, is used. Double-element, two-position, polyphase relays are used for the track circuits, the local element taking 110 volts, and the track element working at .088 to .2 volt, according as the windings of the coils are connected in parallel or series respectively.

The three-position signal mechanisms and train-stop mechanisms are operated by 110 volts, split-phase induction motors, and the controls for them are taken through contacts on double-element, three-position, polyphase relays, both elements taking 110 volts. The signal mechanism cannot act, however, until the train-stop mechanism has operated and the arm is clear of the trip gear fitted on the train, as the signal mechanism circuit is taken through a contact, which is only made when the tripper arm is in the "off" position.

Three-position colour light signals are fixed in places where semaphores are not convenient, two types being in use. In one the three lenses—red, yellow and green—are arranged vertically, and in the other they are arranged triangularly. There is also a short section of two-position colour light signals on the Flemington racecourse line, a length of 1½ miles.

The signal-boxes are provided with illuminated track diagrams to indicate the movements of trains in the vicinity of the interlocked area, and with every modern appliance that facilitates the operation of traffic with the utmost safety. With the exception of South Yarra, the existing signal-boxes have been equipped with the necessary apparatus, and in several places the number of levers has been reduced considerably. At South Yarra an electro-mechanical interlocking frame has been in service for some time, the signal levers being of the miniature pull and push type. Arrangements are in hand to install an all-electric frame at "D" Box, Flinders-street, Melbourne. Up to the present, only one electric point mechanism has been put into service. It is an alternating-current point mechanism using 110 volts, and has been under observation for several months for trial purposes, during which time it has given every satisfaction. It is intended that the points worked from Flinders-street "D" Box shall be operated by power mechanisms.

The whole of the work has been developed, and is being carried out by the signal department, and with the exception of patented apparatus, such as track, point detection and signal control relays, signal and train-stop mechanisms, &c., the greater part of the appliances used has been designed and manufactured by the department's staff under the Engineer of Signals, Mr. F. M. Calcutt, M. Inst. C.E.

Single Line Automatic Signalling.

In addition to power signalling for double-line working within the suburban area, a section of single-line automatic signals has been installed for 3½ miles on the 2ft. 6in. gauge railway between Upper Fern Tree Gully—23 miles from Melbourne—and Belgrave, replacing the train staff and ticket system in conjunction with Winter's single-line block instruments. These signals were brought into service in December, 1921, and are giving every satisfaction. The "absolute permissive block" system, devised by the General Railway Signal Company, of Rochester, U.S.A., has been adopted, and three-position, upper-quadrant signal mechanisms are used, with 500 ampère-hour Waterbury soda cells for motive power.

It is noteworthy that Victoria is the second country, Canada being the first, to bring automatic signals for single-line working into operation within the British Empire. There is every likelihood of the system being extended to many other sections where such a system is deemed advisable for the more efficient and speedy operation of traffic.

Present Operating Results.

At the end of December, 1921, there were 359 mechanism signals and 75 light signals in service. This number includes power signals for shunting purposes, and as speed signalling is in operation, the multiplicity of arms has been avoided. The sections at present signalled on this system are:—Essendon to Elsternwick, 11 miles; Flinders-street, Melbourne, to Montague, 1½ miles; Flinders-street to St. Kilda, 3½ miles; Princes Bridge, Melbourne, to Clifton Hill, 3½ miles; Newmarket to Flemington Racecourse, 1½ miles; Flinders-street to Caulfield, 6½ miles (4 miles of four-track); and Flinders-street to East Richmond, 2 miles.

In addition to installing power signals, the conversion of track circuits around Flinders-street and Spencer-street yards, between Montague and Port Melbourne, 1 mile; Clifton Hill and Alphington, 2½ miles; Clifton Hill and North Carlton, 2 miles; and other places, has been completed. Construction work has also been done, but that has not yet been brought into use, on lines for which no economical

results can be expected until the whole of the scheme has been brought into operation.

Special arrangements have had to be provided at level crossings where electric trains pass over electric tramways, so that the power for an electric train is insulated from, and will not interfere with, the transmission system belonging to the trams when the railway supply is occupying the section, and *vice versâ* when the tram is occupying the section.

Under the present circumstances, and until the whole scheme has been brought into operation, it will not be possible to arrive at any conclusive financial results; but the installation of the signals has enabled greatly increased traffic to be carried over the existing tracks, and to carry the same amount of traffic would have necessitated doubling the track capacity in several cases, the interest charges for the latter work would have greatly exceeded the present interest charges due to power signalling. In one section signalling is provided for forty trains per hour, several sections are signalled for thirty trains per hour, and on the majority of the remaining lines signalling is arranged for twenty trains per hour. In all these cases the 90 deg., or "Clear" aspect is displayed, indicating that a train will not be stopped at the following signal. The increased safety due to the provision of train stops, the improved and consistent signal indications, and the general efficiency of the system cannot be measured in terms of money, but have to be recognised when contrasting power signalling with mechanical signalling.

Caulfield Line.

The latest line to be fitted with power signalling is that from South Yarra to Caulfield, a distance of 4 miles, between which stations there are four tracks. The line was fully equipped with direct-current track circuits and signal reversers. To have retained the direct-current signal reversers whilst converting the track circuits to alternating current would have required a large expenditure with no pecuniary advantages. For a less additional expenditure it was estimated that the lines could be fully equipped with power signalling, thereby permitting the abolition of two signal-boxes and a reduction in the number of working hours at two other boxes.

As now arranged, a former seventeen-lever frame (seventeen working) has been replaced by a ten-lever frame (five working, five spare) at Armadale, where two signal levers operate seven signal mechanisms, and a former seventeen-lever frame (fifteen working, two spare) has been replaced by a five-lever frame (five working) at Malvern. Both these new interlocking frames have been placed in signal bays situated on the island platforms, so as to facilitate operating by signal porters. Under normal conditions the two signal bays are closed, and the signals controlled from the framework automatically. Illuminated letters "A" are provided at those signals with square-ended arms, and when the arm is at danger and the signal-box control is cut out, the circuit is completed to the lamps behind a stencilled "A" fitted in a special lamp case placed on the front of the mast. This letter indicates to the driver that he may pass the signal when at "danger" under the same regulations as apply to an automatic signal. When the sidings are required to be used, and point movements are necessary, one of the station staff does the necessary operation of the levers, thus dispensing with a permanent signalman. The signal-boxes at Hawksborn and Toorak have been completely abolished.

The work was completed and brought into use in December, 1921, and the wages bill has been reduced by 75 per cent., thus making a considerable saving per annum. After provision for interest, depreciation, power consumption, &c., is allowed, it is now estimated that the net annual saving due to the installation of power signalling will amount to over £2000. The signalling has been arranged for 2½ min. with "Caution" signals or 3 min. with "Clear" signals, allowing for stopping trains. When non-stopping trains are run on the "through" lines, a 2-min. service is possible.

Clifton Hill Line.

This line, 3¼ miles long, serves a large industrial district, and there is a very heavy and constant traffic. Signalling requirements were necessary for a 2-min. headway at a maximum permitted speed of 35 miles per hour for electric trains. Under the mechanical signalling arrangements, five signal-boxes between Princes Bridge and Clifton Hill were necessary, and the installation of automatic signals in April, 1921, has enabled four of these boxes to be abolished. At the fifth box signal porters are in attendance when goods trains have to be worked into the sidings. The signal porters receive less wages than signalmen, and when not attending to signalling are engaged on platform duties.

After providing for interest, depreciation, signal lighting and power operation charges, it has been found possible to make a substantial reduction in the costs of operating this line, owing to the installation of automatic signals. At the same time, the capacity of the tracks has been increased by the closer spacing of the signals.

Conclusion.

Although the financial results will not be available until the completion of the scheme, the operating results are already apparent. The train operating staff was thoroughly instructed in the new method of giving signal indications before the system was brought into use, and general approval has been expressed by the drivers and others since the signals have been in operation. In addition, it was recognised that the men who were going to maintain the apparatus should have an opportunity of learning the essential features, both technical and practical, of alternating-current signalling and track circuits. No efforts have been spared to fit the men for their new duties, classes have been held for those who were required to know the system and for those in the signal department who were sufficiently interested to gain increased knowledge, and these efforts have resulted in a progressive type of signal maintainer. The indoor technical staff has received similar but more extended training, and has thus been able to deal with all the phases of power signalling in an efficient manner. The whole of the apparatus has proved very satisfactory, and the percentage of signal failures to signal movements is low.

Obituary.

ALEXANDER GRAHAM BELL.

To Dr. Alexander Graham Bell, whose death occurred on Wednesday of this week, the world owed a great debt for the invention of the telephone. Bell was born in Edinburgh in March, 1847, and at the age of fourteen he came to London, where he was instructed by his grandfather in elocution and the theory of speech. Returning later to Edinburgh he studied at the University and subsequently became a schoolmaster at Elgin. Later still he acted as assistant to his father, who was at that time lecturer on elocution in the University College, London; and, having matriculated at the London University, he then attended medical classes. During this time, it seems, he met two eminent scientists, Alexander J. Ellis and Sir Charles Wheatstone, from whom he acquired knowledge which in later years proved of great assistance to him in connection with the development of his telephone. Mr. Ellis, it appears, called his attention to the experiments of Helmholtz, which showed that tuning forks could be kept in a state of vibration by electro-magnets; whilst Sir Charles Wheatstone provided him with knowledge relating to telegraphy and an ingenious talking machine devised by Baron de Kampelin.

When quite a young man Bell crossed the Atlantic with his father, and at the age of twenty-five he was appointed Professor of Vocal Physiology at the Boston University. Whilst working on multiple telegraphy at Brantford in Ontario in the middle of 1874 he realised that speech could be transmitted over wires if the variations in current produced by speech could be made to move an iron diaphragm in the same way as the air is moved during the passage of sound. The first telephone was made in 1875, whilst the first experiments in what was then considered long-distance transmission were carried out in 1876, when the Dominion Telegraph Company placed lines at his disposal in order that he might test the practical possibilities of his idea. The transmitting apparatus was in Paris, Ontario, and the receiver in Brantford, eight miles away. Speech was first transmitted in one direction only, but subsequently conversations were carried on by two persons at opposite ends of the line.

Like many other great inventions, Bell's telephone met with a good deal of opposition at the outset, and even when it was proved that the idea was thoroughly sound and practicable, the inventor experienced considerable difficulty in obtaining support from financiers, who regarded the instrument as a scientific toy; whilst the suggestion that public telephone exchanges should be established caused no small amount of amusement. Bell's patent for the telephone was violently attacked by a number of other inventors, and possibly no other invention has involved more litigation. It is said that during one of the many suits which involved the validity of the patent he was in the witness box for fifty-two days, but in the end his claim was upheld.

Dr. Graham Bell's inventive faculties were very far from exhausted by the work he did in perfecting the telephone, for in later years he accomplished much original work in connection with the photophone and the gramophone, and made experiments in artificial flight. He was a writer of no mean order on scientific subjects, and the recipient of various honorary degrees, including, among others, the Albert Medal of the Royal Society of Arts and the Hughes Medal of the Royal Society.

The Melbourne Tramways Board is submitting for official sanction a scheme to construct an electric tramline traversing a portion of the heart of Melbourne. The estimated capital cost of the undertaking is £270,000. The Board expects that in order to provide for extended services and the conversion to electricity of the present cable traction in the centre of Melbourne, it will be necessary in future to provide from fifty to sixty new tramcars annually for a number of years. Half of these requirements will be met by calling tenders from outside firms.

Literature.

Filtration. By T. Roland Wollaston, M.I. Mech. E. London: Sir Isaac Pitman and Sons, Limited. 2s. 6d. net.

This is one of a series of technical primers edited by R. E. Neale, B.Sc., in each of which it is the aim of the author to treat in a practical and elementary manner the fundamental principles of some subdivision of technology. Although the subject of filtration is a comprehensive one, in which the engineer, chemist, and biologist each plays an important part, Mr. Wollaston has attempted with commendable success to describe to the reader the principles, processes and apparatus employed in the treatment and filtration of water, air and oil. The contents of the book are divided into eight chapters, in which the processes of chemical precipitation, coagulation, and sedimentation, as well as the physical and chemical methods are described. The chapter on industrial filtration contains illustrations and particulars of the most widely used appliances for removing visible suspended solids, such as coke filters, cloth filters, open filter beds and the leading types of pressure sand filters, which might equally well have been included in the chapter upon the filtration of public water supplies. The chapter on centrifugal and vacuum filtration describes how centrifugal force is utilised, together with sieving and difference of density, and the chapter on air filtration contains a description of the method of separating dust and moisture from air and gases by electrical means, a process for which the author prophesies an extensive adoption for industrial and public welfare purposes. The book is very neatly illustrated and is not too bulky to be carried in the pocket without inconvenience.

SHORT NOTICES.

Manual of Electrical Undertakings and Directory of Officials, 1921–1922. Compiled under the direction of Emile Garcke, M.I.E.E. London: Electrical Press, Limited. Price 30s. net.—This new edition of "Garcke's Manual" covers 2760 electrical undertakings, whilst the first issue, which was published twenty-five years ago, only dealt with 200 undertakings. Articles and notes in the section on the "Progress of the Year" refer to a number of interesting matters, such as the reorganisation of electricity supply, the Electricity Commissioners' decisions on schemes submitted, water power resources in the British Empire, fuel consumption for units generated in the United Kingdom, electricity supply industry in Canada and New Zealand, electric supply companies in China, electrification of railways, the Imperial wireless chain, telephone administration, Post Office telegraph and telephone statistics, &c.

Magnetism and Electricity. By B. J. Paley York, M.Sc. London: Edward Arnold and Co.—So many books have been written on magnetism and electricity that it is always interesting to try to discover in what respect a new book differs from its predecessors. In the present case the author explains that in issuing this new edition he is merely meeting the standing demand which has existed for the book during the past twenty years. He also points out that, although there can be nothing new in an elementary science work, one book may differ from another in the method of treatment. Although the book is, of course, essentially the same as others so far as the nature of the material it contains is concerned, the author has, nevertheless, made all the chapters clear and concise, and on that account it can be recommended to the elementary student.

Insulating Varnishes in Electro-technics. By Arthur R. Matthis. London: John Heywood, Limited. Price 7s. 6d. net.—This is a text-book for the use of electrical engineers and students who desire to study the manufacture and properties of insulating varnishes. The author deals with the subject from a thoroughly practical standpoint. There are sections on the raw materials which enter into the composition of insulating varnishes, papers and cottons, which are the two chief supporting materials, the methods of applying insulating varnishes and compounds, and the tests which should be applied to them. The book should, we think, appeal to electrical men who are engaged upon the manufacture of electrical machines and appliances.

BOOKS RECEIVED.

Marine Engines. By A. Ritchie Leask. London: Simpkin, Marshall and Co., Limited.

The National Physical Laboratory: Collected Researches, Vol. xvi., 1921. London: His Majesty's Stationery Office. Price 20s. net.

Happy India as it Might be Guided by Modern Science. By Arnold Lupton. London: George Allen and Unwin, Limited, 40, Museum-street, W.C. 1. Price 6s. net.

Within the Atom: A Popular View of Electrons and Quanta. By John Mills. London: George Routledge and Sons, Limited, Broadway House, Carter-lane, E.C. Price 6s. net.

The Una-Flow Steam Engine. By Professor Dr. Ing. h.c. J. Stumpf. Translated by the Stumpf Una-Flow Engine Company, Inc., 401, S.A. and K. Building, Syracuse, N.Y. Second edition. Syracuse, N.Y.: The Stumpf Una-Flow Engine Company, Inc.

The Design and Construction of Dams, including Masonry, Earth, Rock Fill, Timber and Steel Structures, also the Principal Types of Movable Dams. By E. Wegmann. Seventh edition. London: Chapman and Hall, Limited, Henrietta-street, W.C. 2. Price 50s. net.

THE CRANE WORKS OF THOMAS SMITH AND SONS, LTD., RODLEY

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ERECTING SHOP NO. 2—ELECTRIC CRANE DEPARTMENT

A Crane Works at Rodley.

ALTHOUGH Rodley is not in itself a place of any great size, it has for close upon a century been well-known in the engineering world chiefly on account of its connection with the manufacture of locomotive cranes. Rodley is situated about five miles out of Leeds, but it is within the municipal area administered by the Corporation of that city. There it was, as long ago as 1820, that the founder of the firm now known as Thomas Smith and Sons (Rodley), Limited, established himself in a small way and applied his efforts to building lifting and handling devices, the power for operating which was presumably provided by manual labour. With the subsequent development of the steam engine, and at a still later date of the electric motor, progress in this branch of engineering became rapid; cranes of greater capacity and higher speed were evolved, and gradually the powerful locomotive crane was developed. It was in connection with this type of machine that the firm, the works of which we illustrate on page 122 and herewith, made its name. On various occasions the works have had to be extended to cope with the increasing business until they now stand on an area of over 15 acres of ground.

Since its foundation, the business and its management have remained entirely in the hands of the Smith family. The founder had one son, the late Mr. Thomas Smith, and the present directorate—the business having been converted into a private limited company in 1917—is vested in his sons, Messrs. Frederick H. Smith, Walter T. Smith, and George E. Smith.

The establishment has been laid out in a manner which allows the work in progress to pass from stage to stage, from the foundry to the testing and dispatch departments in proper sequence. The machine shop equipment includes an elaborate system of jigs which expedites the work of production and ensures the interchangeability of component parts. Incidentally, this equipment gives users of the firm's cranes the best possible service in the replacement of worn or broken parts, a matter of great importance. The tool equipment is excellent. We understand that recently a sum of £40,000 has been expended in replacing old and worn machinery with new and modern plant suited to the economic production of present-day cranes.

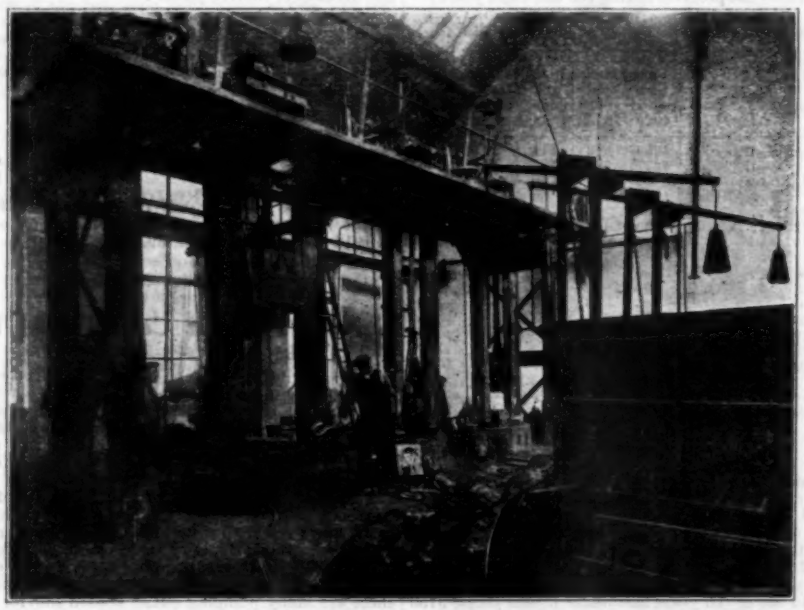
The principal features of the works are as follows:—The pattern shop is well equipped with wood-working machinery; adjoining it is the foundry, where there are two 4-ton cupolas served by an electric hoist. The foundry building is 176ft. by 72ft., and it contains two 20-ton overhead cranes and four 30-cwt. wall cranes. The moulding equipment includes two McDonald machines for boxes up to 16 cwt. and 28 cwt. respectively. A new brass foundry measuring 48ft. by 23ft. has been recently built. There is a three-pothole furnace, one for 300 lb. and two for 100 lb. pots. Adjacent to the foundry are the smiths' shop and forge. The latter is exceptionally well equipped, and includes three Brett's drop hammers of 7 cwt., 12 cwt., and 30 cwt. respectively. The machine shop is 240ft. long by 112ft. wide, and the grouping system has been adopted in the lay-out of the machine tools. A side gallery is arranged as a production department for small component parts. A portion of this gallery forms the electricians' shop, which is responsible for all the electrical auxiliaries connected with new cranes and also for general works maintenance. An enclosure within the machine shop contains the tool room. This department has a most important relationship to the production departments generally, for on it falls the duty of providing and maintaining of all gauges, jigs and tools. It is furnished with the most modern machinery.

The erecting shop is 322ft. long by 88ft. wide, and it runs tandem with the machine shop. It consists of two sections devoted to the erection of steam and electric cranes respectively. The floor is served by two electric overhead cranes of 20 tons and 30 tons capacity, whilst fixed to every alternate pillar is a 1-ton electric wall crane. There is a full installation of electric and compressed air drills, and there is also an oxy-acetylene plant. In an annexe is the joiners' shop for dealing with the woodwork in connection with the crane cabs, &c. At the end of the erecting shop is a trial yard for testing both steam and electric cranes. Facilities are also provided for testing all types of motors; alternating current at any voltage or periodicity being obtainable by means of a special converter set of 100 horse-power, whilst direct current is supplied by high and low-voltage machines.

The girder shop and pattern stores are situated on the opposite side of the road to the main works. The girder shop is spanned by two bays, each 40ft. wide by 100ft. long. These shops have a 5-ton and a 10-ton overhead crane over the machine and erecting bays respectively. The entire works is well served in the matter of inside transport by electric trucks, which have proved to be speedy and very economical in operation. An important feature of the works is the process stores. The various standardised component parts are put through the machine shop in batches, and when finished are passed into the stores to be drawn upon by the erecting department. Standardised component parts are always kept in stock, and the stores form an important link in the firm's service, in allowing the quick dispatch of parts required for replacements, breakdowns, &c. The works are driven by electric power throughout, and all current is generated by Belliss-Westinghouse sets in the firm's own power-house. Individual drives are common throughout the works, but where that method is not suitable, sectional drives are arranged.

The first steam crane was sent out from Rodley over seventy years ago, and it is more than fifty years since the firm delivered the first shunting crane. The company was amongst the first crane builders to adopt electricity as a motive power. Electric locomotive cranes are now an important branch of its business, and twenty cranes of its manufacture were used in the construction of the Rosyth Harbour. Magnet cranes are also being built for general service on stocking grounds, scrap yards, &c.

THE COMPONENT PART STORES



DROP FORGING DEPARTMENT

Lloyd's Register of Shipping.

THE new edition of Lloyd's Register Book contains, as usual, very complete particulars of all the sea-going vessels of the world of 100 tons and upwards, and, in addition, of the steel and iron vessels trading on the Great Lakes of North America. It includes a full record of upwards of 35,000 steamers, motor vessels and sailing vessels, as well as many lists of great practical value to the shipping community, such as:—Signal letters assigned to all sea-going vessels; shipbuilders and marine engineers in all countries; telegraphic and postal addresses of firms connected with shipping in all parts of the world; particulars of dry and wet docks, ports, harbours, &c., at home and abroad; particulars of speeds of merchant steamers capable of 12 knots; particulars of deadweight and cubic capacities of cargo steamers and motor vessels; bulk oil carriers; shipowners and managers, with the names and tonnages of their respective vessels, &c.

A section of the book which is of great interest is that containing the statistical tables. Of them, Table No. 1 shows the number, gross tonnage, description and material of the vessels of 100 tons and upwards, belonging to each of the several countries of the world. Table No. 2—a new table—shows the number and tonnage of steam and motor trawlers, drifters and other fishing vessels of 100 tons gross and above. There are at present 3625 such vessels recorded in the Register Book and over 54 per cent. of them are owned in the United Kingdom. Table No. 3 illustrates the demand of each country for certain sizes of vessels. The table, which divides the steamers owned in the world, distinguishing the principal maritime countries, according to certain divisions of gross tonnage, shows that just over half the total number of steamers in existence consists of vessels of less than 1000 tons each, while of the 7465 ocean-going steamers of 3000 tons and upwards less than 4½ per cent. consists of vessels of 10,000 tons and above. Table No. 4—a new table—shows the number of steamers and motor vessels according to certain divisions of tonnage and of age owned in the several countries of the world. Table No. 5 shows the number and tonnage of all vessels in existence which are or were formerly classed with Lloyd's Register. From it it appears that over 28¾ million tons of shipping are actually or are about to be classed by the Society, and that the existing vessels which were formerly classed total over 9¾ million tons. These figures indicate the general appreciation of the value of the classification of Lloyd's Register, and that such recognition is world-wide is proved by the fact that the total of 28¾ million tons includes over 15¼ million tons of vessels owned abroad, and also that of the total steel and iron sea-going merchant tonnage now in existence 65 per cent. has been built under the survey of Lloyd's Register. Table No. 6 shows the number of vessels according to certain divisions of tonnage classed by different classification societies. Tables Nos. 7, 8 and 10 are extracted from the annual shipbuilding returns issued by the Society. They show the total number of vessels launched by the various countries of the world each year from 1892 onwards; and the number of vessels according to certain divisions of gross tonnage launched yearly during that period in the United Kingdom, and also abroad during the years 1918–1921. Table No. 9—a new table—shows the number and tonnage of steamers and motor vessels lost throughout the world owing to marine and war casualties during the last twenty years, distinguishing the losses of the principal maritime countries. Cases of vessels broken up, condemned, &c., not due to stress of weather, are excluded. An interesting point of this table is that it gives for each country the percentage lost of the total tonnage owned. During this period of twenty years (excluding the five war years 1914–18) the average percentage of loss of United Kingdom vessels only amounts to 1 per cent. of the tonnage owned. The huge amount of war losses is well shown by the fact that, whereas the yearly average of the world's losses of steamers for the three pre-

war years (1911–1913) was only 448,342 tons, the average for the four years 1915–18 reaches 3,628,800 tons. Table No. 11 shows the number and gross tonnage of new vessels classed by Lloyd's Register during the calendar year 1921. Notwithstanding the general depression in the shipbuilding industry the tonnage of these vessels reached the high total of 2,893,865 tons. The table gives the country of build of the vessels, showing that 1,240,000 tons were built in the United Kingdom as compared with 859,000 tons in the United States and 795,000 tons in other countries.

Sailing Tonnage.

From the tables it appears that the reduction in sailing tonnage since pre-war time—say, June, 1914—amounts to 952,000 tons, a much smaller decrease than occurred in the previous period of eight years. This result is principally due to the increase which has taken place in the United States, the only country that has added to its sailing tonnage since 1914, apart from any ex-German tonnage allocated. Over 41 per cent. of the world's sailing tonnage is now owned in the United States. It should, however, be remembered that the figures for that country include a large proportion of sailing barges. The other countries which still have a considerable amount of sailing tonnage are:—France, with 308,000 tons; the United Kingdom, with 207,000 tons; Norway, with 183,000 tons; and Italy, with 168,000 tons. The percentage of sailing vessels to the world's tonnage is now 4.7 per cent., as compared with 8 per cent. in 1914, and nearly 22 per cent. in 1902.

The tonnage of wood vessels owned in 1914 amounted to 1 per cent. of the total steam tonnage, whereas for the present year that percentage has risen to 3.6 per cent. This is, of course, one of the effects of the shortage of tonnage during the war, which resulted in the construction of a large number of wood vessels. Whereas in 1914 the wood sea-going steam tonnage owned in the United States amounted to 210,000 tons, the corresponding figure is now no less than 1,147,000 tons. Wood vessels, however, are not of great importance in international trade, and for the purposes of comparison it would perhaps be more accurate if they were excluded. For this reason in the following figures, which show the steam and motor tonnage owned by the principal maritime countries, now and eight years ago, only steel and iron sea-going vessels are included.

Sea-going Steel and Iron Steamers and Motor Vessels Owned by the Principal Maritime Countries.

Country.	June, 1914. Tons gross.	June, 1922. Tons gross.	Difference between 1922 and 1914 Tons gross.
United Kingdom	18,877,000	19,053,000	+ 176,000
British Dominions	1,407,000	2,201,000	+ 794,000
America (United States)	1,837,000	12,506,000	+ 10,669,000
Austria-Hungary	1,052,000	Nil	—
Denmark	768,000	944,000	+ 176,000
France	1,918,000	3,303,000	+ 1,385,000
Germany	5,098,000	1,783,000	- 3,315,000
Greece	820,000	653,000	- 167,000
Holland	1,471,000	2,613,000	+ 1,142,000
Italy	1,428,000	2,600,000	+ 1,172,000
Japan	1,642,000	3,325,000	+ 1,683,000
Norway	1,923,000	2,337,000	+ 414,000
Spain	883,000	1,187,000	+ 304,000
Sweden	992,000	996,000	+ 4,000
Other countries	2,398,000	3,301,000	+ 903,000
Total abroad	23,637,000	37,749,000	+ 14,112,000
World's total	42,514,000	56,802,000	+ 14,288,000

It will be seen that amongst the principal countries, apart from Germany, Greece is the only one which still shows a reduction in the tonnage now owned as compared with 1914. Notwithstanding the increased construction and the large amount of ex-enemy tonnage allocated to British ownership, and, of course, included in the figures, there are at the present time only 176,000 tons more owned in the United Kingdom than in 1914. The sea-going tonnage of the United States has increased by over 10¾ million tons. The other countries in which the largest increases are recorded are:—Japan, with 1,683,000 tons; France, with 1,385,000 tons; Italy, with 1,172,000 tons; and Holland, with 1,142,000 tons. As in the case of the United Kingdom, the figures for France and Italy include a considerable amount of ex-enemy tonnage allocated to them. The figures for Germany conclusively show the change in the maritime position of that country. While in 1914 Germany ranked next to the United Kingdom with over 5,000,000 tons of sea-going steel and iron steamers, such tonnage now stands at only 1,783,000 tons. The United States percentage of the world's sea-going steel and iron steam tonnage has increased from 4.3 in 1914 to 22 in 1922. The relative position of some other countries has also altered to a large extent. In 1914 the United Kingdom owned nearly 44½ per cent. of the world's sea-going steam tonnage, the present percentage is just over 33½. Norway, which occupied the third place, is now seventh, while Japan, which was sixth, is now third, closely followed by France with only 22,000 tons less. Taken together, the Scandinavian countries—Norway, Sweden and Denmark—show an increase as compared with 1914 of 594,000 tons.

Summarising the totals, the present position of the sea-going merchant steel and iron steam tonnage as compared with 1914 is as follows:—

	Tons.
Increase in the United Kingdom	176,000
Increase in the United States	10,669,000
Increase in other countries	7,810,000
Total	18,655,000
Loss to Germany	3,315,000
Ex-Austro-Hungarian tonnage	1,052,000
Total	4,367,000
Net world's increase since 1914	14,288,000

A comparison between the figures issued in the 1922–23 and the 1921–22 editions of Lloyd's Register Book shows that the world's total steam and motor tonnage recorded in the present edition exceeds by 2¼ million tons the figures for the previous year. The countries in which the largest increases have taken place during the twelve months are given at the top of the next column.

	Tons.
Germany	1,131,000
Holland	409,000
British Dominions	258,000
France	239,000
Japan	232,000
Italy	231,000

The increase in the tonnage recorded as German in the new edition of the Register Book as compared with the 1921 edition is due partly to new vessels built in the years 1920–1922 and now registered as German, and partly to the transfer to German flag of ex-German vessels which had been allocated or sold to other countries. On the other hand, the figures for the United Kingdom actually show a decrease for the year of 231,000 tons, owing no doubt to the large amount of tonnage sold abroad.

In 1914 there were 3668 sea-going steamers, each of 4000 tons and above; there are now 5519. The greatest increase has taken place in those of between 6000 and 10,000 tons, their number having increased from 1004 in 1914 to 1926 in 1922.

The following table shows the relative position of the principal maritime countries as regards the number of large vessels and also the progress during the last eight years:—

Sea-going Steamers and Motor Vessels of 4000 Tons and Above.

Country.	4000 and under 6000	6000 and under 10,000	10,000 and under 15,000	15,000 and above	Total.
British Empire—1914	1283	462	111	27	1883
1922	1277	725	137	51	2190
America (U. States)—1914	82	50	10	1	143
1922	789	615	60	12	1476
France—1914	103	52	12	2	169
1922	190	104	19	3	316
Holland—1914	62	42	5	3	112
1922	108	129	7	4	248
Italy—1914	80	27	—	—	107
1922	191	78	6	4	279
Japan—1914	61	43	7	—	111
1922	200	97	11	—	308
Norway—1914	58	12	2	—	72
1922	113	40	2	—	155
Other countries—1914	703	316	31	21	1071
1922	394	138	13	2	547
Grand total—1914	2432	1004	178	54	3668
1922	3262	1926	255	76	5519

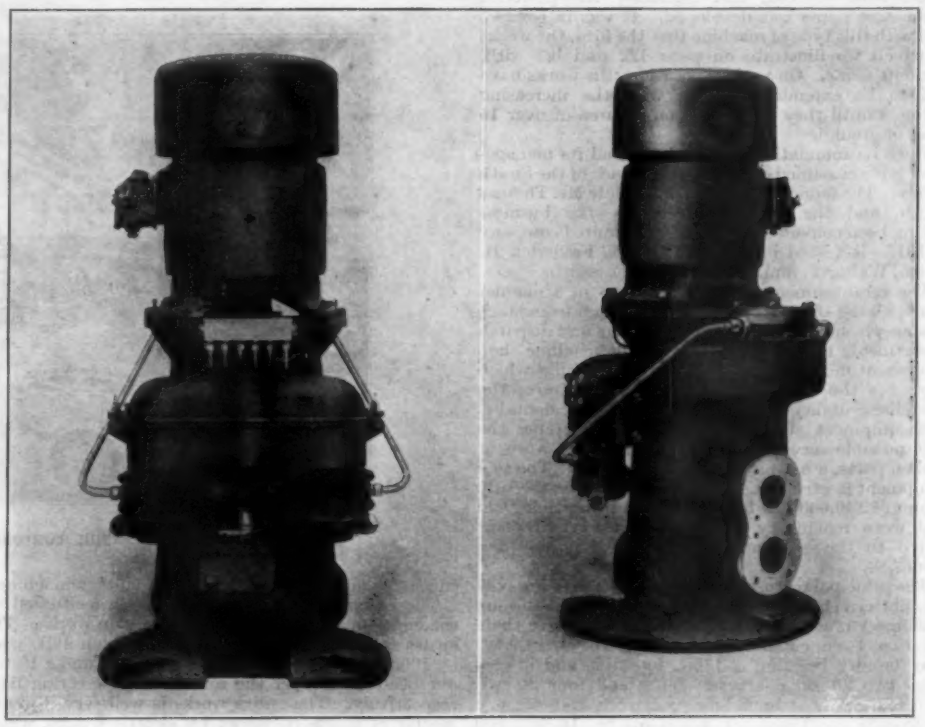
The statistical tables for this year include, amongst others, a new table showing for the various countries of the world the number of steamers and motor vessels according to certain divisions of gross tonnage and according to certain divisions of age. It appears that, out of a total of 29,255 vessels of 100 tons and above, 8522 are less than five years old, 4165 are of five years and under ten years, 3540 are of ten years and under fifteen years, 3750 are of fifteen and under twenty years, 2899 are of twenty and under twenty-five years, and 6379 vessels are of twenty-five years and over. A striking point is the large proportion of comparatively new vessels owned in some countries, no doubt owing to the large number of vessels built during and after the war; for instance, of the sea-going vessels of the United States nearly 63 per cent. have been built in the last five years. Similar percentages for other countries are:—Japan, 40 per cent.; France and Holland, both 33½ per cent.; Germany, 31½ per cent.; Belgium, 31 per cent.; and Denmark, 30 per cent.; whereas the percentage in the United Kingdom is less than 23. Of the 76 largest vessels now owned in the world—those of 15,000 tons and above—33 are under five years old, eighteen between five and ten years old, and the other 25 between ten and twenty-five years old.

An analysis made of the vessels entered in the special lists included in the Register Book brings forth some very interesting points. Whereas in 1914 there were in existence 385 steamers for the carriage of petroleum in bulk with a total tonnage of 1,479,000 tons, the present book includes 977 steamers and motor vessels of 5,057,000 tons for that trade, an increase of 242 per cent. in the tonnage. If the smaller vessels were excluded—say, those of under 2000 tons, which are mostly used for local trade—the average of the others (823 of 4,915,525 tons) would reach 5973 tons each. Included in the total are 353 vessels of between 6000 and 10,000 tons and 43 of over 10,000 tons each. The number of vessels fitted with internal combustion engines has increased enormously since 1914. At that date 290 such vessels of 234,000 tons were recorded in the Register Book, and now the total figures are 1639 of 1,511,000 tons, including 149 vessels of over 3000 tons each with a total tonnage of 848,000 tons.

A great development has also taken place as regards the use of liquid fuel on board steamers. In 1914 there were 364 steamers of 1,310,000 tons fitted for burning oil fuel, whereas the present Register Book includes no less than 2793 such vessels of 14,383,000 tons, which tonnage is nearly eleven times that of 1914. The following interesting comparison between the two years may be noted as regards the division of motive power:—

	1914. Per cent. of total gross tonnage.	1922. Per cent. of total gross tonnage
Sail power only	7.95	4.70
Oil, &c., in internal combustion engines	0.47	2.35
Oil fuel for boilers	2.62	22.34
Coal	88.96	70.61
	100.00	100.00

It will thus be seen that only 70.6 per cent. of the tonnage of the merchant marine now depends upon coal, while in 1914 the percentage was 89.



FRONT AND BACK VIEWS OF THE DRYSDALE CENTREX PUMP

A New Type of Centrifugal Pump.

With the introduction of electrically driven centrifugal pumps for marine service, there has been a tendency of late to adopt the vertical spindle design in preference to the horizontal type over which it possesses certain advantages. In addition to its being lighter and occupying less floor space, the upright pump is more easily accessible, its alignment is more certain and is less likely to be disturbed by connecting pipes or the movement of the ship. Furthermore, the position of the motor is such that it is easily protected from water, and its commutator is readily examined. While the centrifugal pump, however, is quite practicable for direct sea pumping for salt water circulating systems, salt water piston cooling, and sanitary work, there are many pumping duties aboard ship for which the ordinary type of centrifugal pump is not so satisfactory on account of the unavoidable presence of air in the suction system. This means that the pump and the suction pipe must be primed before water can be raised. In bilge and ballast pumping on board ship, there is usually air present in the suction pipe, owing to small leakages in pipe joints, the occasional uncovering of the strum boxes when the ship rolls, and the fact that the ship construction does not always allow of the free flow of water to the suction pipe, especially when the tanks are nearly empty.

In order to overcome this difficulty, Drysdale and Co., Limited, of Yoker, Glasgow, have recently introduced a new design of pump, known as the Centrex, in which the air is first separated from the water, after which both air and water are dealt with separately by properly designed pumps. The action of the Centrex pump is thus analogous to the newer systems which are used in connection with the marine surface condenser. When the water reaches the

suction branch of the pump, it is made to flow over a weir, where the larger portion of the air is automatically released. This air is collected on the top of the suction chamber, and dealt with by a small reciprocating air pump, while the centrifugal pump deals with the water. The top of the suction chamber is provided with a float valve, so that should there be no air or only a little air present, the water rises up and closes the valve in the pipe leading to the air pump. Normally, the air pump is not called upon to deal with water, but should the float valve become at any time inoperative through accident, the design of the air pump is so arranged that it can handle effectively as much water as is delivered through the air pipe.

The illustrations we give on the opposite page will serve to show some of the chief features of this pump. The main casing which, unless otherwise specified, is in cast iron with renewable wearing parts, is extended to form an air-separating chamber and the motor seating. It is provided with a hand hole, giving access to the impeller eye, and it is in two parts so as to enable the impeller and spindle to be removed without breaking any pipe joints. The hydraulic design of the pump is such that by using a single-sided type of impeller the thrust is in the upward direction, and the whole unit is practically free from bearing pressures when the pump is running. The air pumps are two in number, and are constructed of gun-metal. They are driven from the pump spindle through a cross shaft by means of worm gearing. The suction valves are of the piston valve type, while the discharge valves are of the metallic disc type, and are readily accessible. It will be noted that the suction and discharge branches are situated at the back of the pump directly over one another, thereby doing away with the necessity of banding the pump. The bearings are arranged for easy examination, and the thrust and end journal bearings are of the ball type, the former having two ball races, so that it can take the thrust in either direction. The electric motor is drip-proof and its design incorporates the best features of the vertical spindle protected type. The pump we have described has, so the makers inform us, been applied to motor ship service with success.

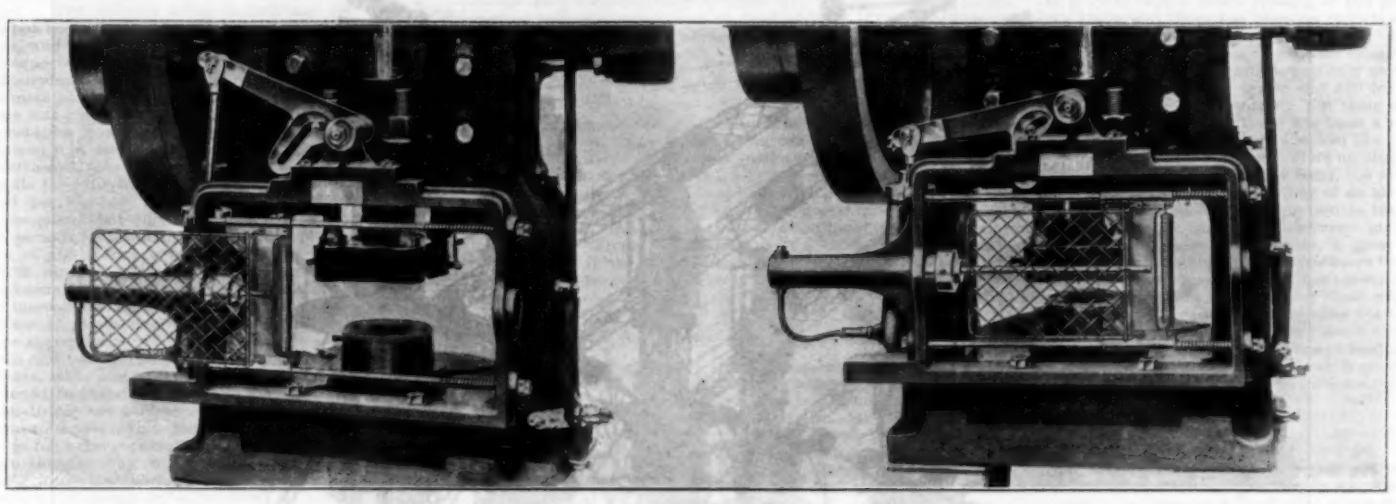
A Pneumatic Power Press Guard.

INCREASED insistence, as is well known, is now being exercised by the Home Office upon the guarding of power presses with a view to preventing the operators from receiving injury to their hands by the descending slides. Various attempts have, of course, been made in the past to supply a satisfactory guard for this purpose, but so far as some of these devices have been concerned, it is to be feared that the workpeople regarded them as nuisances and deliberately discarded them. Some of the appliances so fitted have on the whole fulfilled their function fairly well, but have met with objection on the ground that they interfered with the output and greatly complicated and delayed the re-setting of the press tools.

A new form of press guard, distinguished by the fact that it is not purely mechanical, but is operated pneumatically, has recently been invented by Hordern and Mason, of Vulcan Works, Vesey-street, Birmingham, and is illustrated herewith. This device is carried by a framework which is fixed to the bed of the press by means of two screws only, so as to permit it to be removed or attached very quickly—in less than two minutes, the makers claim. It is adaptable to any size or pattern of press, and does not call for adjustment when the press tools are changed.

A small projecting pin attached to the press slide engages within a slot in a lever fulcrumed on the framework of the guard. The slot is so shaped that the lever is completely and quickly depressed during the earlier portion of the slide stroke, the remaining portion being accomplished without movement of the lever. Similarly on the up stroke, the lever does not begin to rise until the slide has ascended nearly to the top of its stroke. The lever is connected to the rod of a small compressor cylinder pivoted to oscillate on the framework. On the down stroke of the slide the air compressed in this cylinder is delivered through a flexible tube to a horizontal cylinder on the framework, and as a result the wire guard is moved across to the right up against the spring buffer stops. In this position the air in the cylinders falls to atmospheric pressure. The return movement of the guard is effected by the partial vacuum created by the upward movement of the compressor piston.

The guard is claimed to be silent and effective. The power applied to it is more than enough to push the operator's hand out of danger, but is not sufficient to break his wrist. Should the hand be in danger when the guard closes, it is pushed out of the way by the flexible spring attached to the advancing edge of the guard. It is claimed by the makers that this guard does not in any way diminish the output of the press, but rather increases it by giving an assurance of safety to the operator. It is stated that it is the only pneumatic guard in existence, and that the patent rights for the pneumatic operation of such guards will, if infringed, be defended.



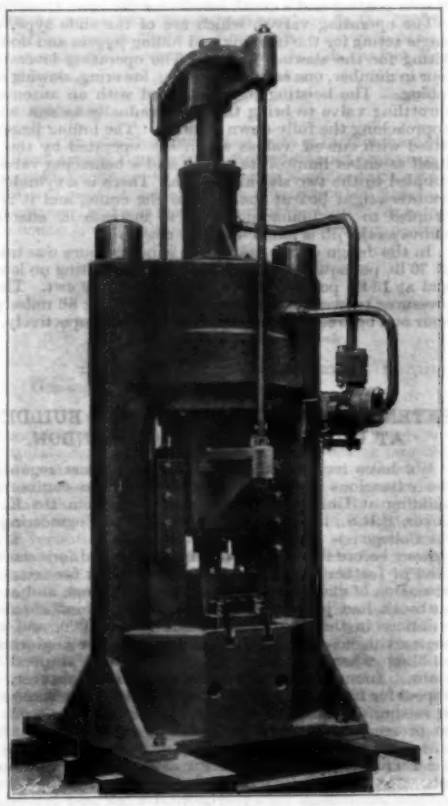
PNEUMATICALLY-OPERATED POWER PRESS GUARD—OPEN AND SHUT

A Hydraulic Punching Machine.

THE machine illustrated by the accompanying engraving is one of the most noteworthy items in an extensive plant for manufacturing dredger buckets and heavy conveyor chains, which has just been supplied to the Butterley Company, of Derby, by Hollings and Guest, Limited, of Birmingham.

The machine in question is a hydraulic punch for making the side links for the chains of dredgers. It will punch out to correct shape two ends of links at one stroke, and is capable of dealing with material up to 3in. in width by ⅝in. in thickness. The ram operating the slide and the punch is arranged to work downwards, so that the work itself is stationary. The return movement of the main ram is effected by an automatic pull-back. The slide is a massive casting, working in substantial guides which have large wearing surfaces machined in the solid casting. The punching dies and bolster can be adjusted to give proper alignment, and are fitted with an automatic stripping arrangement. Provision is made for the punchings to fall clear of the bolster so that there is no danger of choking. An adjustable stop is provided and can be arranged to suit different lengths of links. Once this stop is set, the operator has simply to feed the bar of metal from which links are punched through the die up to the stop and operate the press, when any number of links may be produced all of exactly the same length. Although the punch has been installed for the purpose of making dredger links, a machine of this description can, of course, be readily adapted to other types of work by providing tools of suitable shape. Such a change is an easy matter, as the tools are entirely separate, and can be quickly changed to suit the work in hand.

In addition to the punching machine illustrated, Hollings and Guest supplied a large set of horizontal pumps driven by an electric motor through chain gears, a large accumulator, a powerful bending press for dealing with heavy plates up to 6ft. in width, cold, a horizontal press of special design for bending and forming angles, bars and various rolled sections, together with the whole of the valves, piping and fittings to complete the plant.



HYDRAULIC PUNCH FOR MAKING CHAIN LINKS

Catalogues.

THE SKEFKO BALL BEARING COMPANY, Limited, Luton.—New transmission catalogue.

STANTON IRONWORKS COMPANY, Limited, near Nottingham.—July list of cast iron pipes in stock.

THE LINCOLN MOTOR COMPANY.—A copy of an illustrated pamphlet which deals with the Leland-built Lincoln motor car.

RUSTON AND HORNSBY, Limited, Lincoln.—Illustrated mailing card 4286, entitled "What Do You Do with Your Waste Wood?"

C. W. RICHARDSON, Reliance Works, Lower Carrs, Stockport.—Leaflet on Richardson's R.P. pump lubricator of the single-feed type.

HERBERT MORRIS, Limited, Loughborough.—A copy of Book No. 98, a short review of the wide range of the firm's manufactures.

SIMPLEX CONDUITS, Limited, Garrison-lane, Birmingham.—List 952, giving particulars of the new pattern "Diaduct" distribution boards.

W. H. A. ROBERTSON AND CO., Limited, Lynton Works, Bedford.—A new illustrated catalogue of air compressors, vacuum pumps and desiccating sets.

C. REDMAN AND SONS, Limited, Pioneer Ironworks, Parkinson-lane, Halifax.—A copy of this firm's new brochure has been received. Lathes and planers are described and illustrated.

BRUNTONS, Wire Mills, Musselburgh, Scotland.—A new booklet on splicing and socketing wire ropes. A great deal of new information with illustrations has been embodied in this work.

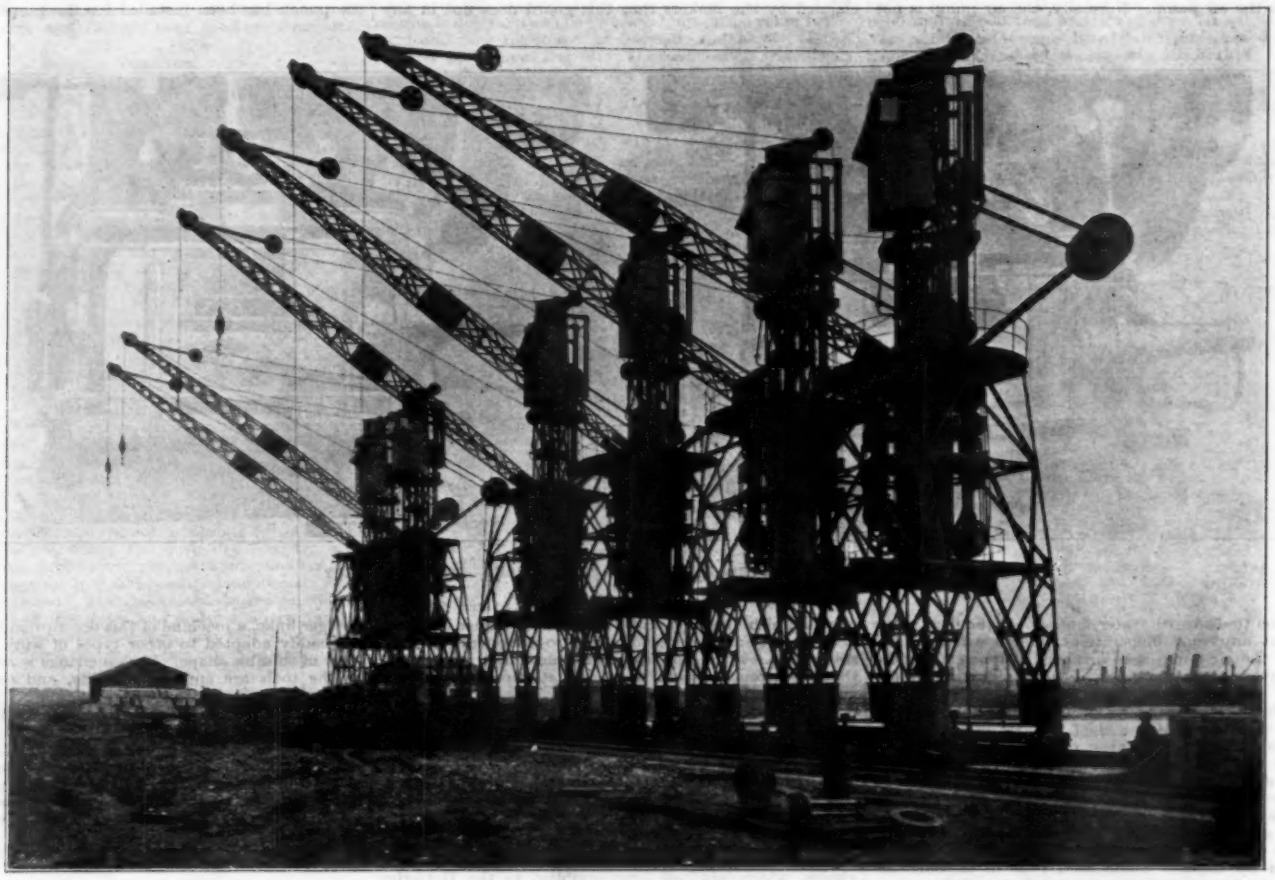
THOMAS SUMMERSON AND SONS, Limited, Darlington.—Catalogue of railway materials and accessories, which also embodies a short description of Reeves' patented connecting-rod for switches.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Institution of Automobile Engineers has just issued to its members a further set of data sheets—Nos. 8 to 51 inclusive—for insertion in the loose-leaf binding cover issued with the first seven, as described in a recent issue. The new sheets cover too wide a range of subjects for detailed mention, but all alike should be most useful to the practising automobile engineer. They include various conversion and other tables of general engineering interest besides many of particular importance in connection with the design and performance of mechanically propelled road vehicles.

PRESENTATION OF MOTOR FIRE ENGINE TO HERTFORD.—The new motor fire engine which Sir Edward Pearson, the Mayor, is presenting to the Hertford Corporation arrived at Hertford on Tuesday, July 25th, and was taken to Sir Edward's country seat, Brickendonbury, near Hertford, where a test was carried out in the presence of the donor and the town councillors. The public trial and presentation at Hertford took place on the following day, when, after the naming ceremony had been performed by Lady Pearson, who named the engine "Firefly," the machine proceeded to the bottom of Bull Plain, and was got to work from the river, one, two and four jets being shown in action through long lines of hose, with satisfactory results. The motor was then taken to the Shire Hall, where the first-aid jet with which it is fitted was shown in operation, the pump taking its supply of water from a tank carried on the engine itself. The new machine is of the Merryweather "Hatfield" type, with a 35 horse-power four-cylinder petrol motor, and a pump designed to deliver 250 gallons per minute. A light extension ladder, which reaches to 30ft., is carried overhead.

30-CWT. HYDRAULIC WHARF CRANES FOR TILBURY DOCKS

SIR WILLIAM ARROL AND CO., LTD., GLASGOW, ENGINEERS



30-Cwt. Hydraulic Wharf Cranes.

An equipment of six 30-cwt. hydraulic wharf cranes has recently been supplied by Sir William Arrol and Co., Limited, to the Port of London Authority for use at Tilbury Docks. A view of the six cranes taken on the site is given in the accompanying engraving.

The leading particulars of the cranes are as follows :—

Maximum working radius	48ft.
Minimum working radius	20ft.
Height of lift above quay	45ft.
Depth of lift below quay	30ft.
Total range of lift	75ft.
Centres of rails	13ft. 6in.
Clearance under portal	14ft.
Angle of slew	310 deg.
Hydraulic working pressure	750 lb. per sq. in.

Hoisting speed with 30 cwt., 300ft. per minute ; slewing speed with 30 cwt. at maximum radius at 360 deg. per minute against a 15 lb. wind ; luffing speed with 30 cwt. at 150ft. per minute average speed ; travelling about 5ft. per minute. The hoisting, slewing and luffing motions are operated by hydraulic power, but the travelling along the wharf is done by hand.

The gantry is built up of rolled steel angles and channel sections and plates braced and riveted together, with a clear opening at the base for the Tilbury loading gauge. Above the portal heavy cross girders are provided to carry the centre pivot bearing and the rotating mast, and from the outer corners the frames are carried up to a horizontal roller-path at the top of gantry. The mast consists of a rectangular section tower, built up of four rolled steel corner angles braced together and provided with plates and connections at the foot, for the bottom pivot bearing ; at the centre for the four horizontal rollers at the roller-path, and the jib and ballast strut connections ; and at the top for the derricking and compensating pulleys and rope attachments. The jib is built up of four rolled steel corner angles riveted and braced together, fitted with stiffening diaphragms, and provided with plate connections at each end for the pulley and bottom fulcrum pins.

The crane truck consists of rolled steel channels braced together. Cast iron distance pieces 3in. deep are arranged between the gantry and the truck to compensate for the difference in level of the track rails.

The hoisting gear consists of a six purchase hydraulic jigger fixed inside the mast. The ram crosshead has two guide rollers working in guides riveted to the mast structure. The rope is led from the bottom of the jigger to a fixed pulley on the mast, and thence to the pulley at the jib head. The load is carried on a single part rope provided with a forged steel cargo safety hook and swivel and overhauling weight to Port of London Authority standard.

The luffing gear is operated by a four-purchase hydraulic jigger, the last purchase being coupled to the luffing pulleys, so that when the jib is luffed in the hoisting rope is paid out, and *vice versâ*. This compensating gear, which is of the Arrol design, is arranged to give a practically horizontal path of load when luffing.

The slewing gear is operated by two six-purchase hydraulic jiggers fixed one on each side of the mast. The ropes from jiggers lead on to a fixed drum on the gantry cross girders at the bottom pivot bearing for the mast. The crane is carried on four cast steel double-flanged wheels, the journals of which revolve in roller bearings. One wheel on each side is provided with two reductions of spur gearing and a crank handle for the hand travelling.

The operating valves, which are of the slide type, are single acting for the hoisting and luffing jiggers and double acting for the slewing jiggers. The operating levers are four in number, one each for hoisting, lowering, slewing and luffing. The hoisting jigger is fitted with an automatic throttling valve to bring the load gradually to rest when approaching the fully down position. The luffing jigger is fitted with cut-off valves which are operated by the jib itself at either limit of its travel, and a balancing valve is coupled to the two slewing jiggers. There is a cylindrical counterweight box at the back of the crane, and it is so coupled to the luffing jigger as to increase its effective radius as the jib is luffed out, and *vice versâ*.

In the design of the cranes the wind pressure was taken at 30 lb. per square foot when the crane is lifting no loads, and at 15 lb. per square foot when lifting 30 cwt. These pressures represent wind forces of just under 80 miles per hour and between 50 and 60 miles per hour respectively.

EXTENSION OF THE ENGINEERING BUILDING AT UNIVERSITY COLLEGE, LONDON.

We have received the following particulars regarding the extensions recently carried out to the engineering building at University College, London, from Dr. E. C. Coker, F.R.S., the Dean of the Faculty of Engineering at the College :—

Long before the war University College had foreseen the need of further development of its facilities for scientific education of chemists, physicists and engineers, and at its outbreak had just completed one of the finest chemical buildings in the country at a cost of £120,000, and was engaged in considering the extension of the engineering building when hostilities commenced and stopped its plans. Immediately after the Armistice, however, an appeal for funds to carry out this extension was successful in raising about £45,000, which has enabled the work to be prosecuted in stages so arranged as not to interfere with the normal activities of the various departments of the Engineering Faculty. As a first step, the hydraulic laboratory was largely extended and re-equipped with modern appliances for experimental work and investigation, while the machine shop was moved to an adjoining site, with a large accession of modern tools for the manufacture and upkeep of experimental machines and apparatus.

These alterations and additions, completed about a year ago, formed the preliminary stage to the main project of extending the engineering wing on its present site by the addition of two more storeys. During the vacation of 1921 a massive floor was built over the existing main laboratory, on the floor of which latter several new heat engines of modern types have since been installed, thereby affording a much wider range of experimental work than had been possible before, while additions are still being made, and especially to bring the department of steam engineering abreast of modern requirements.

The addition of this overhead floor has made it possible to carry on all the further building operations without interfering with the work of the Engineering School, and there is now no doubt that the new floors, giving about 10,000 square feet of additional space, will be completed by the commencement of the new session next October.

The lower of these floors will be devoted to students who desire to carry on advanced investigation and research on the applications of science to engineering, and it is hoped with these facilities, the contributions to applied science, which this—the oldest school of engineering in England—has made in the past, will not be less in value or amount in the future. The topmost storey will provde an extension of the drawing-office accommodation, and also for other work of the various Departments of Civil, Mechanical, Municipal and Electrical Engineering. The increased facilities available will also make it possible to co-operate more fully than ever with the University School of Architecture and the Department of Heating and Ventilating Engineering at University College, and also with the new School of Chemical Engineering, for which a building is being planned in connection with the Ramsay Memorial Fund.

THE YARROW CONVALESCENT HOME.

The Yarrow Convalescent Home for Children at Broadstairs, which was built and endowed by Sir Alfred Yarrow twenty-seven years ago, is an institution of peculiar interest to engineers, and it was not surprising to find that they were prominently represented at the gathering which assembled at Broadstairs on Saturday last to celebrate Founder's Day. According to the trust deed creating the home, which was signed on May 17th, 1894—the first children were admitted at its opening nearly a year later—the home is for the children of professional and well-educated people whose means will not allow them without assistance to give their children the change of air which is so beneficial when recovering from illness or operation. Accommodation is provided for fifty boys and fifty girls, and the work of the home is carried on throughout the year, no less than 16,804 children having been admitted up to the date of our writing. In 1903 the management of the home was accepted by the Institution of Civil Engineers, this body being represented on Saturday last by the president, Mr. W. B. Worthington, and the secretary, Dr. Jeffcott. After the war it was found that, owing to the increase of cost of almost everything, the Endowment Fund, which had previously been ample, was not sufficient to carry on the home at its fullest efficiency, for whereas in 1913 the average weekly cost per child was £1 4s. 2½d., in 1921 it had increased to £2 6s. 6½d. In order to meet the altered conditions, however, the founder has generously made a large addition to the endowment. At the present time a charge is made to parents according to their means, the amount averaging about 10s. per week. Further particulars will be gladly given on application to the secretary, at the London office, 116, Victoria-street, S.W. 1.

The home owes much to the personal interest of Sir Alfred Yarrow, who was present, and was accompanied by his two sons, Messrs. Harold E. and Norman Yarrow.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

A Quiet Market.—Continental Competition.

The interest taken in iron and steel this week has not been great, indeed it has not come up to expectations, and with the holidays close at hand too much was not expected. Business on 'Change at Birmingham to-day—Thursday—can only be described as dull. Orders for the most part were restricted to very small quantities, and there was a marked falling off even of these. There is no expectation now of anything but hand-to-mouth buying between now and September. The iron trade generally, nevertheless, takes a somewhat hopeful view of the position despite the intensified continental competition, of which a good deal has been heard during the past two weeks. It is recognised that July and August are almost invariably dull periods for the iron trade, and the practical completeness of the stoppage in Scotland for summer holidays affects most English districts, including the Midlands. Producers of iron and steel in Staffordshire cannot ignore the increased foreign competition which has made itself evident in recent weeks. Belgian producers are growing more aggressive every day, and in such products as steel semis and bar iron are becoming quite a menace to home makers, who, before they can get their production costs adjusted to the cuts they have made in selling prices in order to recover control of the markets, are being called upon to answer this renewed challenge from quarters where for various reasons iron and steel can be produced more cheaply than in this country. The importation of billets into this district is assuming uncomfortable proportions. One big lot is reported to have been bought recently at less than £7 per ton, whereas our own makers require anything from £7 5s. to £7 10s. per ton according to size and quality. With regard to the manufactured iron business, as I stated in this column last week, Belgian makers of nut and bolt bars have been taking a number of good orders out of the Black Country recently. Business has been done in Belgian nut and bolt bar iron at £8 12s. 6d. delivered, and even this price has been shaded in an endeavour to capture orders from the Darlaston makers. South Staffordshire makers of nut and bolt bars have had their hands forced considerably, and in some cases have accepted business at £1 above the Belgian figure. Mill-owners generally stand out for at least £9 17s. 6d., however. They make so little out of it at that price that they say they will withdraw from the market rather than accept less. The position is a serious one for the Staffordshire ironmaster, and it is trusted that this diversion of appreciable orders to the foreigner will not be continued. It is anticipated in some quarters that the appreciation of the franc exchange will lead to a good many of these low continental quotations for both iron and steel being withdrawn. It is sincerely hoped such will be the case.

Manufactured Iron.

The finished iron trade of this area is still slightly busier, but there continue to be heard many complaints of unprofitable prices, particularly by makers of the lower-grade material. The bi-monthly return regulating wages under the Midland Iron and Steel Wages Board, which has this week been published, shows that the wages of iron-workers are to undergo a further reduction of 5 per cent. on the basis rates, taking effect from August 7th and operating until October 7th. Some little relief will be experienced as a result. Business in marked bars continues good, the mills being fairly well employed on orders taken at the standard price of £13 10s. Merchant iron prices continue difficult to fix. While quite a good class of merchant bar can be obtained at £11, some makers quote £11 10s., while North Staffordshire mills demand £11 15s. The value of hurdle bars remains steady at £10 to £10 2s. 6d. Nut and bolt bars are not being bought so largely as they were a few weeks ago. Consumers are specifying fairly well on contracts, however, and though experience is variable, some of the mills are fairly well engaged. The check in the subsidence of values has not been maintained. Home quotations for nut and bolt qualities continue to range from £9 12s. 6d. to £9 17s. 6d., with, in exceptional cases, £9 10s. mentioned. In isolated cases this latter figure is stated to have been accepted. Belgian prices appear to depreciate much more markedly than those at home. The Belgian export trade is very much under the dominion of the speculator, however. There is very little scruple about exploiting purely transitory influences, and those who have accepted the low prices offered know they are running risks of delay and perhaps worse.

Pig Iron.

Certain Midland smelters who have been sending considerable quantities of pig iron to the North are just now missing the Scottish market, which is closed owing to the holidays being in progress, and there is a good deal of complaint this week of lack of business. At some furnaces stocks are still rather heavy, and the damping down of several furnaces, both at Barrow and Middlesbrough, is generally attributed to the very slow revival of engineering following the strike. Sales of pig iron this week have been mostly confined to 25-ton lots. Values are not quotably changed, but they are again developing the irregularity which characterised them during the later stages of the engineering lock-out. The improved inquiry for forge material noted last week is maintained. It is due possibly to a re-stocking movement in the distributive channels of the bar trade, and hopes have been kindled that it may be reinforced after August by a broadening of consumptive demand.

Steel.

Steel is neglected for the most part, but some of the Lancashire mills are stated to have booked good orders for baling hoops for India and Egypt. An exception to the general dullness has been a good deal of business in semi-finished steel, certain large merchants having this week sold thousands of tons both of English and Belgian billets. This buying of semi-finished material is in itself a good sign, indicating that the present is a temporary opportunity which customers think it prudent to utilise. Billet makers complain of the unprofitableness of prices. The incursions of Belgian cutters is viewed in some circles with indifference, while in others a more serious view is taken. Sellers at home have not altered their quotations. Most of them require £7 7s. 6d. for soft billets, though in some instances £7 5s. is the ruling price. It is possible to buy Belgian billets slightly under £7. There is a good deal of talk of lower prices of finished steel as a likely event, following the undoubted weakening of combination among British steel makers.

Fuel.

Iron and steel makers here are taking rather a serious view of the prospective increase in fuel values. The iron and steel trades are a good deal affected by the brisk export trade done in coal. At present the shipments to America are amounting to about 100,000 tons per day, and fuel values have hardened. This American business is, of course, due to the coal strike. Up to the present coke has not been advanced in price to local iron and steel masters, but if this contingency arises pig iron makers will have to increase their prices or face additional business losses.

The Reduced Rail Rates.

The importance of the slightly lower rail rates which have come into force this week appears to have been exaggerated by many consumers, who in numerous cases have asked for abatements of quotation on this account. They have derived little satisfaction, the reply in many cases being that, in the cases referred to, the total saving to the manufacturer has been 2d. per ton, through the fall in the flat rate from 6d. to 4d.

The Birmingham Brass Trade.

There has recently been a slight stimulus to buying in the Birmingham brass trade, which suggests that wholesale and retail stocks are again being replenished to some extent. The industry is among the least depressed in the Midlands, and it is benefiting considerably at the moment from the development of various schemes undertaken by public authorities in different parts of the country. So far the resumption of work in the engineering and shipbuilding trades has made very little difference to the demand for steam fittings and other brass and copper products.

Cannock Chase Miners' Wages Reduced.

Cannock Chase for some months past has been in the position of being the only area in the British coalfields in which miners' wages were not down to the minimum. That state of affairs exists no longer, for the ascertainment for the month of August, published this week, shows that miners in this area are also to have their wages reduced down to the minimum. The wages for stallmen are to be reduced by 1s. 5d. per day, viz., from 10s. 1d. to 8s. 8d. The July percentage on the 1911 basis is 32, as against 53.78 in June. The new wage of 8s. 8d. is in remarkable contrast to the 16s. 6d. paid in March, 1921.

Obituary.

The death occurred last week in Birmingham of Mr. Alfred Arnold Remington, who until about two years ago was chief engineer to the Wolseley Engineering Company. He was past-president of the Institution of Automobile Engineers, and was the recipient of the O.B.E. for his work in connection with the development of aero engineering.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Outlook.

The markets here are in a certain amount of confusion owing to the relaxing of the various price control regulations, and it will probably be a week or two before things are adjusted and prices settle down under the new conditions. Of course, there has been a good deal of what we may call surreptitious relaxation during the past month or two. That is to say, firms have accepted prices for favourable lots which were not in strict accordance with the rules of the Association to which they belonged, and these irregularities have been winked at. The first step in the process of freedom for individual competition was taken by the Cleveland ironmasters in the matter of pig iron. Then the West Coast hematite makers followed suit, and now it is the turn of the steel manufacturers. When the finished iron people have followed we shall have the whole trade fairly free for a time from the deadening influences of combination. One would like to see the effect of free competition on copper and brass tube prices, but it is to be feared that this will not come just yet. There is more at stake in this industry than in iron and steel, for free competition cannot bring down the prices of iron and steel very much lower than they are at present, whereas free competition for orders for, say, brass condenser tubes might—well, one does not like to say what it might do.

Metals.

The tendency in the copper market has still been towards the approximation of prices between standard and the consumers' qualities of refined copper. There has been only £2 per ton difference between the price of standard and that of best select ingot, and it would seem scarcely possible for this difference to be further diminished. The reason is, of course, that the actual demand here for copper by the consumer is exceedingly small, and that there is very strong competition for any orders that may be obtainable. The reports from America are not so good as they were, and there seems to be a fear that the prolongation of the coal strike will check consumption. The fact that large shipments of coal have been arranged in South Wales and in the North, and that American agents are now trying to secure even Lancashire coal for shipment indicates that American manufacturers anticipate a determined struggle on the part of the coal miners. Meantime electrolytic copper in America has been quoted as high as 14 cents per pound, and this would mean a good deal more than the present current price, say, £70 10s. in the London market; that is to say, when the transport costs were added. The price of copper sheets remains at £94 per ton for the home trade, and there has been no reduction yet in other classes of manufactured copper and brass. In the market for scrap copper and brass there is no change and very little life. The dealers continue to pay only very low prices, say, £50 for clean scrap copper and £40 for gun-metal, and £30 for heavy yellow brass; but their selling prices are very variable. In tin there has been a rather better market, and at one time the price looked like touching £165, but there was some reaction. Here opinion does not seem favourable; but, on the other hand, the opinion in London seems to favour the probability of an attempt to get the market to a higher level. One notices that the premium or contango on metal for delivery in three months has now disappeared. Of course, a great deal will now depend upon whether America continues to buy, for if the shortage of fuel should prevent her consumption of tin there will be no chance of success for those who are trying to get prices up. Lead and spelter have both been very firm markets. Spelter has at last passed the £30 limit and looks like going still higher. Prompt lead is still scarce, but recently there has been some inquiry for delivery in three months, which seems to indicate that the confidence in present prices is growing.

Pig Iron.

There is very little change to report yet in the pig iron market. Hematite remains very weak, and the West Coast prices are now on a level with those on the East Coast; it is only Scotch hematite which remains comparatively dear. The threatened American demand does not seem to have touched hematite yet, although if the coal strike goes on it may be wanted there yet. The market in Manchester for foundry iron remains quiet, and one is inclined to think that the actual demand is now rather less than it was, although the Derbyshire sellers do not admit as much. The chances of a big American demand do not seem to have any effect here, and evidently consumers are in no anxiety, for they continue their policy of buying from hand to mouth. This method of supplying their wants may suit them and the furnaces which are now blowing; but it is of no use to those furnaces which are idle, which require a certain outlet for a large quantity before they can venture to start again.

Finished Material.

The market for manufactured iron and steel is in an uncertain condition. There is a belief amongst consumers here that the longer they wait the better will be their chance of getting cheap material, and this idea may be correct; but, of course, it leads to a very dull condition of trade. It is true that there is not much margin for the reduction of finished steel prices unless the cost of semi-steel can be got down. Manufacturers are well up against costs even at the best equipped works, and are bound to struggle against a fall in the prices.

Scrap.

There has been very little life here in scrap during the week. The foundries buy a little cast iron scrap occasionally, paying about 80s. for good ordinary machinery iron; but they cannot use much in the present state of demand for ordinary castings. Steel scrap is quite neglected and the price is nominal at £2 10s. per ton. Wrought scrap does not come forward at all freely, and the idea is that dealers are holding it back for better prices.

Manchester Association of Engineers.

A delightful afternoon was spent by the members of the Manchester Association of Engineers and their lady friends last Saturday at Vale Royal Abbey, the residence of Mr. R. Dempster, of the firm of R. and J. Dempster, Limited, Manchester. This delightful Cheshire mansion is situated in the brine district between Winsford and Northwich. It is built on the site of a Cistercian abbey founded in 1277 and demolished in the sixteenth century. Vale Royal belongs to, and was formerly the home of, Lord Delamere. It embraces very extensive park land which stretches away down to the river Weaver, and traces of the old monastery are still in evidence. Vale Royal played a very important part in English history in the twelfth to the fourteenth centuries, and was the scene of fierce fighting in the Parliamentary Wars, when a portion was burnt and the whole was plundered by Cromwell's army. The visitors were received at the Abbey by Mr. and Miss Dempster and Mr. D. Adamson, the president, and were then free to roam about the beautiful grounds or listen to the musical discourse of the 3rd Cheshire Military Band. Those members with a taste for archæology found ample material for study in the plans and excavated ruins of the old monastery, which were on view. All were deeply grateful to Mr. Dempster for his kindness and hospitality in inviting the Association to his home.

The Wages Question in the Engineering Trades.

The Engineering and the National Employers' Federations have posted notices in all the works connected with these organisations stating that the existing war bonus of 26s. 6d. per week will be reduced by 5s. 6d. per week from Monday last, and by further similar sums on August 28th and September 25th next, and as all the unions concerned have decided to accept the reductions no serious trouble is expected amongst their members. All the employers with whom I have spoken on the subject have expressed their deep regret that this drastic step was necessary while the cost of living remains so much over the pre-war level, but it was felt that no improvement in the engineering industry is possible until the prices of their products are reduced materially. With very few exceptions the state of the order books in the Manchester district is

such as to cause very grave anxiety to the employers, but there is reason to believe that there are many orders for machinery and plant ready to be placed when there is some confidence that prices have reached the bottom. One sometimes hears the argument that engineers' wages ought to be higher when compared with those paid in other branches of trade, and to this every engineer, whether employer or employed, will agree; but after all, if the scale of payment must be regulated by the state of trade, the argument that because a bricklayer's labourer is obtaining a wage higher than the skilled engineer, the pay of the latter should be raised, will not hold water. If the bricklaying trade was subject to the fierce foreign competition to which the engineering trade is opposed, the relative positions of the workers in the two industries would speedily be reversed. It is to be hoped that the reduction which is now taking place will have the desired effect of improving trade, and that this will enable the system of payment by results to compensate the workers for the temporary reduction in their earnings.

BARROW-IN-FURNESS, Thursday.

Hematite.

There is a change in the hematite iron trade which is rather significant. For some time the West Coast ironmakers have had an agreement as regards prices, but during the last week this agreement appears to have come to an end, for each individual firm is now quoting its own price for mixed Bessemer numbers; in other words, a free market is declared. The price per ton is down so low that it is a question as to whether it covers all costs or whether it involves loss. Cheapening of iron should certainly improve the trade, for some customers were holding back for lower prices. Again, now that the engineers, despite the adverse ballot as to the acceptance of a reduction of the bonus, are remaining at work, there will be a chance of trade developing and more orders for iron being placed. At the moment most trade is in ordinary mixed numbers, and there is very little inquiry for special classes. The latter trade will come along as soon as the engineers get busier.

Iron Ore.

The iron ore trade remains dull. The amount of native ore raised is not large, and is mostly for local consumption. The Hodbarrow mines are not engaged to any great extent and few men are working. Foreign ores are in moderate demand, but there were no importations last week.

Steel.

The only steel works engaged are at Barrow, where the rail, merchant and hoop departments are working. These works take a considerable quantity of the Barrow-made iron. There are not many orders in the market and there is no immediate promise of much activity. Competition is keen. There is still nothing being done in the plate trade or in billets.

Shipbuilding and Engineering.

The shipbuilding and engineering trades are dull. The Australian Commonwealth liner Jervis Bay is completed, but is lying at Barrow until the time comes for her to take up her station. This will probably be in September. There are no new orders reported, but there is a feeling that the worst period has passed. In a month or two there may be a better outlook.

SHEFFIELD.

(From our own Correspondent.)

July's Improvement.

BEARING in mind the fact that it is a holiday month, and that even in normal times local trade invariably shows a marked falling off, the experience of July, so far as it can be ascertained by unofficial inquiry among local manufacturers, is distinctly encouraging. Quite a number of local firms report an increased turnover, and a few of them even go so far as to state that they have done more business than in any previous month this year. A good deal more steel is being made, most of this being of the cheaper varieties. Many of the large furnaces in the Tinsley and Rotherham district are now in full operation. The demand for special steels remains very indifferent, though even here there are bright patches, and some firms are working at something like 50 per cent. capacity. There are signs of a revival in motor car steels and parts, and railway orders are also a little more active, though still very far from the expected boom dimensions. In these departments the experience of different firms varies greatly from week to week; at one time certain firms are working quite briskly while their neighbours are almost idle, and the next week the position may be reversed. This hand-to-mouth existence is proving very trying to all concerned. Even the elimination of Germany as a serious competitor in the steel and tool trades has so far made no appreciable difference to Sheffield's volume of orders.

South African Prospects.

A line in which there happens to be a welcome spurt is in connection with a fairly big order for mining drill hollow steel bars, in which one Sheffield firm specialises. It has in hand orders sufficient to keep this department running for about three months. Indeed, as I have previously mentioned in this column, Sheffield makers are looking more and more to overseas developments to bring them the orders which are so urgently needed. Hopes have centred on the railways in this country, but the long-deferred repairs and renewals seem to be as far off as ever; the outlook from the shipbuilding industry is equally disappointing. What mining developments are being carried out at home seem to have all the tools and equipment necessary for some time to come, and no great development or electrification schemes are likely to materialise in the early future. Sheffield manufacturers of railway materials have therefore learned with considerable satisfaction that—according to the Minister of Railways—South Africa cannot wait much longer for new railways, and while orders cannot be postponed for long, the Government can only afford £4,000,000 for railway schemes. It is also reported that Pretoria proposes the erection of a new power station, and the construction of tramways, a sewage system, a fire station and other public works. The Rand Water Board is also inviting tenders for cast steel pump chambers. These announcements—and others of a similar character from other overseas Dominions—revive hope among local manufacturers, but the prospects of business resulting are, to say the least, uncertain. There have been complaints from representatives of Government Departments, both at home and overseas, that when quotations are invited from a number of Sheffield firms their prices are identical, indicating an "understanding" that may be helpful to the home manufacturers when they can afford to avoid keen competition, but is a mistaken policy when they are "up against" foreign rivalry that they cannot afford to ignore. In certain local industries there is unquestionably a deliberate and strictly enforced price-maintaining organisation, and under prevailing conditions this may prove to be a dangerous policy.

Lincolnshire Rivalry.

While Sheffield steel manufacturers are becoming more and more despondent at the prospects of recovering the city's supremacy in this industry, their competitors in the neighbouring county of Lincolnshire are making great strides. The district suffered perhaps more severely than any other from the dislocation following the coal strike, but the revival, when once started, was remarkably rapid, and to-day the blast-furnaces are once more in fairly full operation. They can produce steel at prices which permit of delivery cheaper in Sheffield than the makers in the city can work at. This is in a measure due to the more modern equipment of the newer plants in Lincolnshire, and the nearness of the ore deposits, and, incidentally, lower local rates and easier and cheaper access to the seaports. A very large proportion of the output from the Lincolnshire furnaces is at present going into South Wales for the tin-plate trade, but export business also shows signs of revival, and, of course, Sheffield is also taking a certain quantity of steel as well as the pig iron. Within the last week it has been reported that American requirements to a total of something like 20,000 tons of basic pig are now being offered to the Lincolnshire makers. The Sheffield pig iron market is also showing a little more activity as a result of the labour troubles in the United States. Billets too are being supplied to the States. Scrap is in slightly better demand, and prices are hardening.

Doncaster Developments.

Doncaster's remarkable strides during recent years are another challenge to Sheffield's claim to be regarded as the metropolis of the South Yorkshire coal area. The growth of the town and district has been so rapid that the authorities have wisely decided on controlling this development and have accordingly called in Professor Abercrombie, head of the Department of Civic Design at Liverpool University, who recently completed a town-planning and civic survey for Sheffield. In conjunction with Mr. T. H. Johnson, a well-known architect and surveyor, Professor Abercrombie has prepared a report in which he demonstrates that South Yorkshire is a district which has a chance of showing that industrial prosperity and development can be achieved without any loss of amenity or health. He advises that in this area there should be ten or more distinct communities, and that there should be a "neutral" zone in which collieries could be developed, and manufacturing areas, apart from the residential zone. Doncaster would thus be surrounded with a ring of satellite town or urban communities, and would become the shopping and financial centre of the region. A population at least three times the present number (30,000) is anticipated.

A Big Order from Japan.

What is said to be the largest armour plate grinding machine ever made has just been completed to the order of the Japanese Government by Taskers Engineering Company, Limited. The grinding wheel is 54in. in diameter, weighs 2 tons, and is designed for a speed of 300 revolutions per minute.

NORTH OF ENGLAND.

(From our own Correspondent.)

The New Battleships.

MUCH speculation is going on in shipbuilding and engineering circles on the North-East Coast regarding the two new battleships which the Admiralty is proposing to order very shortly. In view of the depression in the shipbuilding industry, the widespread unemployment, and the desire of shipbuilders to keep their establishments going, competition to secure some of this important work is certain to be keen, but an optimistic feeling prevails that the North-Eastern area will not be overlooked when the orders are given out. Several Tyneside firms are expected to tender, namely, Sir W. G. Armstrong, Whitworth and Co., Limited, Swan, Hunter, Wigham Richardson, Limited, and the Palmer Shipbuilding Company, Limited, for the hulls of the vessels; and Sir W. G. Armstrong, Whitworth and Co., the Palmer Company, the Wallsend Slipway and Engineering Company, Messrs. Hawthorn, Leslie and Co., and Messrs. Parsons, Wallsend, for the machinery. In addition, Sir W. G. Armstrong, Whitworth and Co. will tender for the armament. When the battleship orders, which were afterwards cancelled as the result of the Washington Conference, were given out last year, Messrs. Swan, Hunter, Wigham Richardson were successful—for the first time in their career—in obtaining one of the contracts, while Messrs. Parsons secured an order for the machinery, the Palmer Company for the boilers, and Sir W. G. Armstrong, Whitworth and Co. an order for the armament. The cancellation of the work was a severe blow to the Tyneside firms, and as some consolation it is felt that the Admiralty should in all fairness allot some of the new work to the firms which suffered by the cancellation.

Boom in the Coal Trade.

The boom in the coal trade continues. In addition to the big American demand, inquiries are coming in from Canada and from continental buyers who had been holding off the market in the hope, now abandoned, of securing lower prices. There is a considerable and rather bitter exasperation at the delay in the shipping arrangements, and as a result many of the collieries are hampered in disposing of their daily output, while a large string of vessels at all the docks and staiths is undergoing considerable detention. The congestion at Dunston and other places on the Tyne has become very serious. For a long time it has been felt that the present facilities are not sufficient to cope with any sudden increase in business, and interested parties are unanimous in calling for a reversion to the three-shift system among coal trimmers and other loading workers on the river. It is felt that if the North-East is to cope adequately with the long-looked-for revival in the coal trade, there is need for action. Colliery owners, shipowners, coal exporters, representatives of the North-Eastern Railway, and of the Tyne Improvement Commission are to meet at an early date to discuss the question, and it is probable that they will seek a conference with the trimmers and transport workers with a view to the three-shift system being re-established.

Iron and Steel Exports.

The exports of pig iron, manufactured iron and steel from the Cleveland district in June reached a satisfactory scale, though they fell below the total for the previous month. The shipments of pig iron amounted to 35,426 tons, of which 21,657 tons went to foreign ports, as compared with a total export of 44,802 tons in June, a decrease of 9145 tons. The United States were again the largest importers, taking 5825 tons, while Italy received 4470 tons, Belgium 3730 tons, Germany 2353 tons, and Sweden 1830 tons. The shipments of manufactured iron and steel showed a gratifying increase, the total being 34,963 tons in July, as compared with 27,167 tons in June. India received 8556 tons, Nigeria 3537 tons, Portuguese West Africa 2210 tons, and Japan 2081 tons.

Cleveland Iron Trade.

The position in the Cleveland iron trade is very dull and apathetic. Buying continues on very moderate lines and there would appear to be but little in the outlook to warrant any hope of substantial improvement until, at all events, the holiday period is over. The demand for special iron from America seems to have fallen away, and any chance that there might have been of any inquiry from the United States for ordinary foundry qualities, owing to the strikes there, has been effectively checked by the rise in freights. Inquiry from the Continent is also very quiet, there being a general absence of confidence in consequence of the chaotic condition of the exchanges. Trade with Germany has been brought to a standstill. Prices are unchanged. No. 3 G.M.B. Cleveland pig iron is quoted at 88s., and is firm at this figure for small quantities, but it can be shaded to 87s. 6d. for substantial lots. No. 1, which is normally at a premium of 5s. above No. 3, is still very strong at 95s., the demand, though not very great, being in excess of the supply. No. 4 foundry stands at 87s. to 87s. 6d. per ton, No. 4 forge at 85s., and mottled and white iron each at 80s.

Hematite Pig Iron.

Business in East Coast hematite pig iron shows no improvement. Inquiry from Italy and elsewhere on the Continent is held up, and some requirements make no adequate impression in order books. But there is practically no change in prices from last week. Mixed numbers are nominally 91s., but against such firm offers quotations are obtainable at only a few coppers over 90s. For land sales 90s. is named, but a lower figure can be done. The premium for No. 1 quality is now no more than 6d. per ton

Iron-making Materials.

There has been no business to test the foreign ore market. Freights show an upward tendency, but best Rubio ore can still be bought at 25s. per ton c.i.f. Tees. Coke remains fairly strong with 27s. as the ruling quotation for good medium furnace qualities delivered at the works.

Manufactured Iron and Steel.

In the manufactured iron and steel trade business is exceedingly quiet, and manufacturers have great difficulty in keeping their plant in operation. Steel prices are unchanged, but iron bars have been reduced 20s. per ton, common iron bars now being £11 per ton.

The Coal Market.

The whole tone of the Northern coal market is exceptionally strong. There has been no abatement in the demand from the United States, and so far as can be at present foreseen there is likely to be an extensive export from the North-East ports for some time to come. There are, however, reports of strenuous efforts being made in America to end the strike there, and should these prove successful there may be an early reaction in the coal position here, but meanwhile the outlook for a continuance of the present firm market is distinctly good and promising. Two very large contracts with continental buyers have been fixed up this week. The Amsterdam Gasworks have purchased through Newcastle merchants 60,000 tons of Wear special gas coal for shipment from August to November next. The price paid was 28s. per ton c.i.f. at Amsterdam, while the German State Railways have purchased about 100,000 tons of best steams at current values. For the most part, however, continental buyers are difficult to persuade to come forward for any substan-

tial bookings at the present high prices, and prefer to await the subsidence of the American famine for fuel. Steam coals are scarce and dear, and this particularly applies to steam smalls, which always command top figures. Gas coals are firm at present figures for all old customers, but much inflated for temporary traders. Bunkers are very scarce, with little or nothing available for early shipment. Coke continues a steady market, all kinds of foundries and gas coke being well upheld.

Ironworkers' Wages Increased.

The accountants to the Board of Conciliation and Arbitration for the manufactured iron and steel trade of the North of England certify that the average selling price of bars and angles for the two months ended June 30th last came out at £11 8s. 0.27d., as compared with £11 5s. 10.24d. for the previous two months. On these figures the sliding scale gives an advance of 2½ per cent. on puddling and other forge and mill wages on the North-East Coast, to take effect from July 31st. The sales for the two months ended June 30th totalled 2026 tons, as compared with 2790 tons for the preceding two months.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

The statistics for the month of July give no evidence of an improving tendency in the shipbuilding trade. During that period eleven vessels of 32,961 tons were launched and one of these accounts for almost one-half of the tonnage total. The July returns are well up to the average for this year, but far below the usual in ordinary times. The Clyde figures for this year to date indicate 73 vessels of 200,454 tons, compared with 131 vessels of 265,248 tons in the same period last year. Chief amongst the vessels launched are the following:—Volendam, twin-screw geared turbine, 15,150 tons, for the Holland-America Line, Rotterdam; Calumet, single-screw cargo steamer, 6580 tons, for Elder, Dempster and Co., Limited, Liverpool; Begum, cargo steamer, 5700 tons, for British owners; and the Dunstaffnage, cargo steamer, 4700 tons, for British owners. Orders for new tonnage are almost as scarce as ever, and builders are not too hopeful. Several inquiries have been reported, but little is heard of any tangible result. At the same time the feeling is prevalent that the autumn months will witness an improvement in conditions.

Wages Decrease.

In view of the fact that, after examination of the employers' books for May and June, the average net selling price was certified as £11 6s. 6d., the wages in the Scottish manufactured iron trade are subject to a reduction of 5 per cent. on basis rates.

Diesel Engines.

Harland and Wolff, Limited, who hold the sole licence for Britain and the Colonies for the construction of Diesel engines of the Burmeister and Wain type, some time ago granted a sub-licence to J. G. Kincaid and Co., Greenock. At a more recent date Messrs. Kincaid entered into a further arrangement with Messrs. Harland and Wolff whereby they are enabled to construct this type of engine for export to Spain, France, and the French colonies. It has now been announced that Messrs. Kincaid have received a contract to supply a set of six-cylinder engines of the type referred to, capable of developing 1350 brake horse-power, to be installed in a vessel being built on the Clyde for British owners. The same firm has also secured an order for another set developing 1900 brake horse-power. It is understood that the latter set is for a leading Spanish firm of shipowners. On completion, the machinery will be shipped to Spain, and will constitute the largest set of the Burmeister and Wain-Harland and Wolff single-screw Diesel engines of the long stroke crosshead type yet constructed in this country.

Steel and Iron.

There have been no fresh developments in the Scotch steel and iron trades. The holiday feeling is yet prevalent, and markets show little movement. Buying is proceeding on meagre lines, consumers showing great care to arrange for nothing beyond actual necessities. A few works are engaged on sectional material, but specifications for plates are extremely scarce. The outlook is not so dull as might be supposed, however. Locomotive and wagon builders have some good orders, and structural and bridge makers are comparatively well employed. Further, the export trade continues to develop on more sure lines and outside competition is not so keen at present. Local consumers have had offers of continental material, but very little business has been done. Many anticipate that home prices will cheapen, and prefer to wait until native material can be purchased at moderate rates.

Coal.

The majority of the collieries are again in operation, though outputs are not yet up to the usual. Home demands remain slow in the extreme as many large industrial concerns are prolonging their holiday time. Inquiries on American account are responsible for the firming up in round coal prices, even although only a few cargoes have yet been arranged for. So far as can be ascertained, from five to seven cargoes have been fixed from the Clyde so far. The Fifeshire and the Lothians district are still busy with shipments of washed materials, chiefly to Germany. A number of boats await loading turns at some of the ports. Washed materials, also, are harder in price. The aggregate shipments for the past week amounted to 288,548 tons against 181,529 tons in the preceding week, and 168,906 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

American Coal Demands.

The coal demands of America and Canada continue to be the governing factor in the coal situation in this district, and the prime subject of discussion. It is true that the excitement created by the first rush of orders is subsiding, but they have left their mark upon the market. The bulk of these orders have been arranged for as regards the tonnage required to lift the coals, and rates of freight have fallen from their best of 16s., free delivery at the North American range of ports, to about 12s. 6d. to 13s., according to the size of the steamers and their position. The steamers already chartered are now coming along, but the bulk of them will be arriving from now onwards over the holidays, and it is expected that the great pressure for coals will be after the holidays, from the 9th to the 20th inst. On paper the majority of the collieries supplying the cargoes are very fully booked up, but some of the tonnage is rather backward, and the consequence is that there is a little easiness in the market for spot shipment, although few exporters can take advantage of this and salesmen are very firm in their ideas regarding their prices for coals for any other position. They have to take into account the fact that the August holidays will mean a reduction in the output, and that supplies will be extremely scarce after this week. The question which is occasioning considerable interest to the coalowners and exporters is to what extent do the further requirements of the Americans and Canadians run. The Americans were very clever in arranging their first supplies, which, as far as can be seen, amounted to about half a million tons. They obtained these coals very cheaply, much to the chagrin of local exporters, who have in many cases incurred considerable losses, and it is unfortunately the case that regular customers of South Wales in France and Italy and elsewhere have now to pay comparatively dear prices if they want supplies, as both coals and freights have advanced. The position so far as America is concerned is somewhat obscure in respect of further demands. In some quarters it is believed that shipments will be required up to the end of the year, while others calculate that two or three months will see the end of the export of coals to the States. Reports are current that the American Government intends commandeering the shipments that have already been arranged, and that further business will be under Government control and through the agency of only a few selected buyers, with the result that speculation by American firms will be eliminated and prices of supplies controlled. Whatever may be the case, it is certain that they will not be able to get further coals on anything like the basis of the first half a million tons. Since that quantity was booked best Admiralty large coals have advanced practically 6s. per ton, and the freight at 13s. is approximately 5s. 6d. higher, although reports are current of the Americans sending a number of their own steamers over to lift their requirements. If this is the case, then British owners will not have much of a look-in, and they will have to seek elsewhere for business. Generally speaking, the rush of American business has not brought in a great deal of fresh inquiry from other quarters. This is largely due to the fact that prices have gone so high, though there is a certain amount of coal needed for public services abroad, and for this, orders will be forthcoming, though there is no doubt that these requirements will be kept down to the minimum. One inquiry received is for the supply of 10,000 tons of Cardiff or Newport small coals for delivery at North French and Bay ports within a month of the closing of the business, for the French State Railways. One thing generally recognised is that the American demands have put a totally different aspect on the outlook for the coal trade so far as the remainder of this year is concerned. It is pretty certain that the low prices of a fortnight or three weeks ago, such as 24s. for best Admiralty large, will not be seen again unless something most extraordinary happens. Such a possibility is regarded as most unlikely, and, in fact, it is indicative of the feeling respecting the future that some of the collieries should already have received tentative inquiries as to their prices for supplies for the first three months of next year.

Miners' Attitude.

The question whether the miners should sanction the export of coals to America for the purpose of breaking the strike of the American miners came up for discussion at a meeting of the Executive Council of the South Wales Federation as the result of a resolution passed by the Rhondda district. This resolution was in the form of a request that the Executive Council should take steps to prevent the coal being supplied from this country. It was stated at the meeting of the Executive that the matter had been considered, and that it had been decided to refer the question to the International Miners' Committee. It was resolved to communicate with the general secretary of the Miners' Federation of Great Britain intimating that in the opinion of the South Wales Miners' Executive Council the international organisation should take steps to prevent coal being supplied to America. It will be interesting to see what comes of this expression of opinion, as no one thinks that such a resolution, coming from the Executive on the strength of a recommendation from the Rhondda district, by any means represents the feeling of the rank and file of the workmen throughout the coalfield.

Three-shift System.

The question whether the docks are equal to the demands to be made upon them by the rush of the American orders has resulted in some discussion as to whether the three-shift system of working at the docks should not be pressed for, but so far as can be ascertained in official quarters, it is unlikely that any steps will be taken to this end. It is regarded as possibly opening the door to labour trouble, which is not desirable, and, furthermore, the railway and dock interests are opposed to it. It is also the case that the present two shifts of eight hours' actual work each are giving results which are considered as very satisfactory, and if a third shift were established it would mean that the working hours of the two shifts in operation would have to be cut down to admit of the third. The time left for the marshalling of traffic would be curtailed, and altogether for the little benefit that might be derived from the change, it is scarcely worth taking up the matter seriously.

Tin-platers' Wages.

A joint meeting of the Welsh Industrial Council at Swansea on Monday considered the question of the continuance of the 7½ per cent. bonus arrangement with the tin-platers. The employers pointed to the rising price of coal as a reason why the 7½ per cent. could not be continued indefinitely, but in the end they agreed to continue the arrangement for a further period of three months. The annual stop in the industry commences to-day (Friday), according to the shifts, and the workmen will recommence on the following Monday week.

Current Business.

Apart from the American business the inquiry from other quarters is on rather modest lines, but a fair amount of business is being done considering the comparatively high prices buyers now have to pay compared with a short time ago. It has also to be borne in mind that the very best large and small coals are practically off the market for the whole of August, and other qualities are also filling up. Best Admiralty large is firmly quoted at 30s., with second qualities at 29s., while superior small coals range from 21s. 6d. to 22s. 6d. Shipowners are feeling the higher cost of their bunkers, so that although they may be getting rather higher rates of freight, they do not really benefit appreciably, if at all in some trades, while so far as American business is concerned, the fact that they will not be able to secure bunkers on the other side means that they will have to take sufficient on this side to cover the round trip. Coke for export is a better market, and patent fuel is steadier, but so far has not felt the improvement displayed in coals. The inquiry for pit-wood is stronger, and prices are from 35s. to 37s. 6d.

Coal Trade.

There is quite a lull in fresh business in steam coals, though collieries are pretty full for this month, excepting inferior grades. Exporters and coalowners are closely watching the American position in case fresh demands for supplies are forthcoming.

Miners' Wages.

The wages of the miners for this month will remain at the minimum. For the first time under the present national wages agreement, the auditors' certificate reports a deficit which will be carried forward and deducted from any future surplus. The sum of £56,480 represents the actual deficit in June.

Swansea Metal Exchange.

The tin-plate market is slightly firmer in view of the approaching stop-week. Business has been a little more active for the Continent, especially with Germany, notwithstanding the adverse rates of exchange, and demands have been received for India, Italy and Portugal, while hopes are entertained of America becoming more interested.

Engineering Films for South America.—During the week we had an opportunity of viewing a special series of films which has been prepared by Vickers Limited for the forthcoming Brazilian Centenary Exhibition at Rio de Janeiro. The films, which are divided into seven sections, deal with the various products of the Vickers organisation, and describe the technical processes of manufacture involved. The River Don Works at Sheffield and the Naval Construction Yards at Barrow-in-Furness are illustrated, and at the latter yard the launching and fitting out of battleships, submarines and merchant ships is shown. An instructive section is devoted to gunnery, and includes the trials of a 15in. naval gun at the Eskmeals range. Interesting sections are those which describe the firm's aeronautical developments. They not only include various historical flights, but give an account of the "Vimy" commercial aeroplanes, the "Viking" amphibian, and the "Valentia" flying boat, and show flights over land and sea.

Contracts.—The Spearing Boiler Company, Limited, has been successful in securing the contract for two water-tube boilers, each of a normal evaporation of 57,650 lb. per boiler, together with Ferguson superheaters, chain grate mechanical stokers, and forced and induced draught plants, for the Charing Cross, West End and City Electricity Supply Company, Limited. —We understand that John G. Kincaid and Co., Limited, of Greenock, have secured an order to supply a set of six-cylinder Burmeister and Wain-Harland and Wolff type of Diesel engines capable of developing 1350 brake horse-power for a new vessel to be built on the Clyde for British owners. The same firm has also been successful in obtaining an order for another set capable of developing 1900 brake horse-power for a leading firm of Spanish shipowners, and on completion the machinery will be shipped to Spain, where it will be installed in a ship building there. It is interesting to note that the latter will be the largest set of the Burmeister and Wain-Harland and Wolff single-screw Diesel engines, of the long-stroke crosshead type, yet constructed in this country.

National Foundry Competition.—The awards for the competitions which were held in connection with the recent Foundry Trades Exhibition at Birmingham were as follows:—Coremaking, Light Castings: 1st prize, G. Green, Smethwick; 2nd, F. F. Ridgeway, Smethwick. Medium Castings: 1st, J. Bishop, Birmingham; 2nd, W. Glover, Willenhall. Heavy Castings: 1st, R. C. Clark, Small Heath; 2nd, W. G. Riley, Ladywood. Floor Moulding: 1st, E. Chorley, Darlaston; 2nd, J. Scott, Sunderland; 3rd, P. London, Bilston. Two-part Moulding: 1st, J. Hartshorne, West Bromwich; 2nd, N. Millard, Capehill; 3rd, W. Stevens, West Bromwich. Three-part Moulding: 1st, L. Ramsbottom, Darlaston; 2nd, A. McBride, Crewe; 3rd, J. A. McIndoe, Aston; Special Prize, F. Haines, Newark. Patternmaking, those over 21 years: 1st, H. Sutcliffe, Halifax; 2nd, W. Jeans, Inverness; 3rd, C. J. Millard, Bilston; 4th, G. Croft, Hexham-on-Tyne. Under 21 years: 1st, H. Grazer, West Bromwich; 2nd, W. L. Leak, Saltley; 3rd, J. Oddy, Smethwick. Students: 1st, W. W. Crew, Wednesbury; 2nd, G. J. Botfield, Handsworth.

Current Prices for Metals and Fuels.

IRON ORE.

N W. Coast—	
Native	25/-
(1) Spanish	25/-
(1) N. African	25/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	25/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	5 8 9	—
No. 1 Foundry	4 17 6	—
No. 3 Foundry	4 12 6	—
N.E. Coast—		
Hematite Mixed Nos.	4 10 0	4 10 0
No. 1	4 10 6	4 10 6
Cleveland—		
No. 1	4 15 0	4 15 0
Silicious Iron	4 15 0	4 15 0
No. 3 G.M.B.	4 8 0	4 8 0
No. 4 Foundry	4 7 0	4 7 0
No. 4 Forge	4 5 0	4 5 0
Mottled	4 0 0	4 0 0
White	4 0 0	4 0 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
Part Mine Forge	*None offering.*	
North Staffs. No. 3 F'dry	4 5 0 to 4 10 0	
(3) Northampton—		
Foundry Nos. 2 and 1	*Nominal.*	
,, No. 3	4 0 0	—
,, Forge	3 10 0 to 3 12 6	
(3) Derbyshire—		
No. 3 Foundry	4 0 0 to 4 2 6	
Forge	3 12 6 to 3 15 0	
(3) Lincolnshire—		
Basic	4 0 0 to 4 5 0	
Foundry	4 5 0 to 4 10 0	
Forge	4 2 6 to 4 5 0	
(4) N.W. Coast—		
N. Lancs. and Cum.		
Hematite Mixed Nos.	5 7 6	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 10 0	10 10 0
Best ,,	12 0 0	—
N.E. Coast—		
Crown Bars	11 0 0	—
Tees	10 10 0	—
Lancs.—		
Crown Bars	11 10 0	—
Second Quality Bars	10 5 0	—
Hoops	14 0 0	13 15 0
S. Yorks.—		
Crown Bars	12 0 0	—
Best ,,	13 0 0	—
Hoops	14 0 0	—
Midlands—		
Crown Bars	11 0 0	—
Marked Bars (Staffs)	13 10 0	—
Nut and Bolt Bars	9 15 0 to 10 0 0	
Gas Tube Strip	11 0 0 to 11 5 0	
Hoops (Nom.)	14 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	13 10 0	—
Ship Plates ½in. and up	10 0 0	—
Sections	9 10 0	—
Steel Sheets ⅜ in. to ½in.	11 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	15 10 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	10 0 0	9 0 0
Angles	9 10 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	8 10 0
Heavy Rails	9 10 0	—
Fish-plates	14 10 0	—
Channels	14 10 0	—
Hard Billets	8 15 0	—
Soft Billets	7 15 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	9 10 0	—
Light ,,	11 0 0 to 13 0 0	
Billets	9 5 0	—
Ship Plates	10 0 0	—
Boiler ,,	13 10 0	—
Manchester—		
Bars (Round)	9 10 0 to 11 10 0	
,, (others)	10 10 0 to 11 10 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	12 5 0	12 0 0
Plates	9 10 0 to 11 0 0	
,, (Lancs. Boiler)	15 10 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Bessemer Billets	12 10 0	—
Hard Basic	8 15 0	—
Soft ,,	7 10 0 to 7 15 0	
Hoops	12 5 0	—
Soft Wire Rods	11 0 0	—
Midlands—		
Small Rolled Bars	9 5 0 to 9 10 0	
Bessemer Billets	7 7 6 to 7 10 0	
Hoops	11 10 0 to 12 0 0	
Gas Tube Strip	10 5 0 to 10 10 0	
Sheets (24 W.G.)	11 15 0 to 12 0 0	
Galv. Sheets (f.o.b. L'pool)	15 12 6 to 16 0 0	
Angles	9 10 0	—
Joists	10 0 0	—
Tees	10 10 0	—
Bridge and Tank Plates	10 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	19/3 to 19/4½
Block Tin (cash)	162 15 0
,, (three months)	162 15 0
Copper (cash)	64 12 6
,, (three months)	64 15 0
Spanish Lead (cash)	25 5 0
,, (three months)	24 10 0
Spelter (cash)	31 5 0
,, (three months)	30 17 6
Manchester—	
Copper, Best Selected Ingots	70 0 0
,, Electrolytic	72 0 0
,, Strong Sheets	94 0 0
,, Loco Tubes	0 1 1½
Brass Loco Tubes	0 0 11½
,, Condenser	0 1 2½
Lead, English	27 0 0
,, Foreign	25 15 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£27	10/-
,, 6 p.c. to 8 p.c. ,,	£25 10 0	9/-
,, 8 p.c. to 10 p.c. ,,	£24 10 0	8/-
,, Specially Refined		
Max. 2 p.c. carbon	£65	26/-
,, 1 p.c. ,,	£80	30/-
,, 0·75 p.c. carbon	£85	37/-
,, carbon free	1/1 per lb.	
Metallic Chromium	5/3 per lb.	
Ferro Manganese (per ton)	£15 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£13 0 0 scale unit	5/- per
,, ,, 75 p.c.	24 10 0 scale unit	6/- per
,, Vanadium	18/- per lb.	
,, Molybdenum	6/6 per lb	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£160	
Cobalt	11/- per lb	
Aluminium (per ton)	£110 to £120 (British Official.)	

FUELS.

	Export.
SCOTLAND.	
Lanarkshire—	
(f.o.b. Glasgow)—Steam	22/-
,, ,, Ell	23/-
,, ,, Splint	23/- to 25/-
,, ,, Trebles	21/6
,, ,, Doubles	20/6
,, ,, Singles	19/6
Ayrshire—	
(f.o.b. Ports)—Steam	22/-
,, ,, Splint	23/-
,, ,, Trebles	21/6
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	21/- to 25/-
Screened Navigation	30/-
Trebles	22/6
Doubles	21/-
Singles	19/6
Lothians—	
(f.o.b. Leith)—Best Steam	22/6
Secondary Steam	21/6
Trebles	22/6
Doubles	21/6
Singles	20/-
ENGLAND.	
(8) N.W. Coast—	
Steams	33/-
Household	46/6 to 57/6
Coke	34/-
Northumberland—	
Best Steams	24/ to 25/-
Second Steams	22/- to 22/6
Steam Smalls	16/- to 17/6
Unscreened	20/6
Household	25/- to 28/-
Durham—	
Best Gas	24/- to 25/-
Second	21/6 to 22/6
Household	25/- to 28/-
Foundry Coke	33/- to 35/-
Sheffield—	Inland.
S. Yorks. Best Steam Hards	21/- to 22/- —
Derbyshire Hards	20/- to 21/- —
Seconds	18/- to 20/- —
Cobbles	17/- to 19/- —
Nuts	16/- to 18/- —
Washed Smalls	10/- to 11/- —
Best Hard Slacks	12/- to 13/- —
Seconds ,,	9/- to 10/6 —
Soft Nutty ,,	7/6 to 8/6 —
Pea ,,	7/- to 8/- —
Small ,,	2/- to 4/6 —
House, Branch	30/- to 33/- —
,, Best Silkstone	27/6 to 29/- —
Blast Furnace Coke (Inland and Export)	19/- to 21/-

Cardiff—	(9) SOUTH WALES.
Steam Coals:	
Best Smokeless Large	30/- to 32/6
Second ,, ,,	29/- to 30/-
Best Dry Large	29/- to 30/-
Ordinary Dry Large	25/- to 27/6
Best Black Vein Large	29/- to 30/-
Western Valley ,,	29/- to 30/-
Best Eastern Valley Large	27/6 to 30/-
Ordinary ,, ,,	25/- to 27/6
Best Steam Smalls	21/- to 22/6
Ordinary ,,	19/- to 21/-
Washed Nuts	25/- to 26/-
No. 3 Rhondda Large	29/- to 30/-
,, ,, Smalls	21/- to 23/-
No. 2 ,, Large	24/- to 26/-
,, ,, Through	21/- to 23/-
,, ,, Smalls	16/- to 17/6
Coke (export)	37/6 to 42/6
Patent Fuel	26/- to 29/6
Pitwood (ex ship)	37/6 to 40/-
Swansea—	
Anthracite Coals:	
Best Large	52/6 to 55/-
Seconds	42/6 to 47/6
Red Vein	32/6 to 35/-
Big Vein	45/- to 50/-
Machine-made Cobbles	65/- to 70/-
Nuts	65/- to 70/-
Beans	37/6 to 42/6
Peas	23/- to 25/-
Breaker Duff	7/6 to 8/-
Rubbly Culm	13/6 to 14/6
Steam Coals:	
Large	21/6 to 25/-
Seconds	20/- to 22/-
Smalls	14/6 to 16/-
Cargo Through	19/6 to 20/6

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England (7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b for export. (9) Per ton f.o.b.

NOTE.—Coal prices for export are still rising.

French Engineering Notes.

(From our Correspondent in Paris.)

Working Hours.

THE edifice of the eight hours' law is crumbling, despite the uncompromising attitude of coal miners and seamen, who vow that they will not allow anyone to touch the sacred principle of this much-maligned measure. Neither the colliers nor the seamen can resist the inevitable, and while in the one case it has been decided to increase the actual working hours from 6½ to 7½, in the other the limit is to be suppressed altogether. In the marine the eight hours' day has been found to be quite inoperative. On the railways the eight hours' day has been made effective, pending a revision of the Bill. Even the legislators who drew up the measure appear to have overlooked the fact that some classes of employees, whose tasks are very intermittent, would only be working two or three hours a day. Further evidence of the desire of the Government to favour any movement for a reasonable increase of working hours is seen in the arrangement which has been come to between the Labour Inspection Department and the silk and textile weaving concerns in the Lyons district to permit of the men working an additional 250 hours a year. To allow for this twenty hours may be added for accidental stoppages of machines, eighty hours for holidays and 150 hours for press of work. The hours must be arranged so that they will not exceed fifty-three a week, with free Saturday afternoons.

Saar Cokes.

The lack of suitable coke is the most serious impediment to the normal production of pig iron in Lorraine and in the adjoining districts. The supplies from the Ruhr are absolutely insufficient. The output of the blast-furnaces is considerably below what it was before the war, and there appears to be no prospect at the moment of its being largely increased. The only hope for the future, therefore, lies in the introduction of new methods for improving the quality of the Saar coke, and for some months past experiments have been carried out with three processes which appear to have given more or less satisfactory results. The process of M. Charpy, involving distillation in two phases, first by a rapid elevation of temperature to produce a semi-coke, followed by a slow distillation, necessitates special ovens, and efforts have therefore been made to obtain similar results in ordinary ovens that may need only a slight modification or no change at all beyond a method of regulating the temperature. Another process tried also involves distillation in two phases, and although the results are not yet uniformly satisfactory, it is said to have produced coke superior to the usual Saar quality and, at times, as good as the Ruhr coke. There is a good deal of confidence in the final success of the system, which has the advantage of employing ordinary ovens and of costing no more than the coke at present produced. Other experiments have been made with a mixture of pulverised coke and low-grade bituminous coal, and here again promising results are said to have been obtained. The efforts being made to improve the Saar coke show, at all events, that there is reasonable hope of the problem being solved in a practical manner.

Port of Paris.

The scheme for the extension of the port of Paris and the deepening of the Seine to Rouen to permit of traffic between the latter town and the northern departments through Paris has been held up for so long a time that the Municipal Council is pressing the Government to undertake the work without further delay. The Commission of the Port of Paris has decided to carry through the programme in four stages. The first consists in immediately improving the port of Pantin, widening and deepening the Ourcq Canal between Pantin and La Forêt, enlarging the locks of the St. Denis Canal, as well as Port Morland and the basin at Bercy. The second part of the programme consists in the construction of canals, the transformation of the Ourcq Canal between La Rosée and La Forêt and the construction of the junction canal at St. Denis. The third stage will be to enlarge the Seine basin at St. Denis and deepen the Seine to a minimum of 15ft. 6in. between Port à l'Anglais and Rouen. Finally, the system will be joined up with the river Marne. The Council sent a delegation last week to the Minister of Public Works to insist upon the urgency of these undertakings, and at the same time it requested the Minister to hasten the inquiry into the construction of the barrage reservoir in the upper part of the Loire basin for the supply of water to Paris from the Val de Loire. This last scheme is meeting with considerable local opposition.

Motor Rail Traction.

The State Railways have decided to put into service on one of the local lines this month a motor coach with trailer vehicles similar to those that have been experimented with for several months on a line near Mantes. The motor coach, weighing 14¼ tons, hauled first one trailer coach of 10 tons at speeds varying from 11 to 32 miles an hour, according to gradient, and with two coaches—that is to say, with a total weight of 34¼ tons—at from 6 to 30 miles, the service being quite as regular on this difficult line as with steam locomotives. The trials were carried out over a total distance of 800 miles, and the consumption of petrol averaged 4 miles to the gallon. The tests will be continued with the train now being put into service, and if satisfactory the use of petrol motor vehicles with trailing coaches will be extended on the local lines.

Tunnelling the Faucille.

As an alternative to the line proposed by the Superior Council of Railways from Switzerland to the Atlantic ports by way of Lyons, the Chambers of Commerce of Nantes and Saint-Nazaire advocate the tunnelling of the Faucille for the construction of a line between Lons-le-Saunier and Geneva. It is argued that this will provide a much shorter and more economical route with very few gradients of any importance. The question of driving a tunnel through the Faucille to avoid the long roundabout climb to Pontarlier was to the fore many years ago, and after long discussion nothing has been heard about it since.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

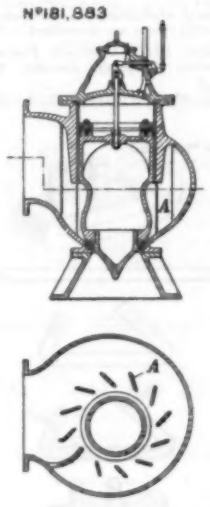
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

TURBINE MACHINERY.

181,883. April 9th, 1921.—HYDRAULIC VALVES, P. W. Seewer, Bracknell, Lynton-road, New Malden, Surrey.

This invention concerns the relief valves fitted on hydraulic turbines for passing water direct to the tailrace when the governor valve cuts off the supply to the turbine. In order to

N°181,883



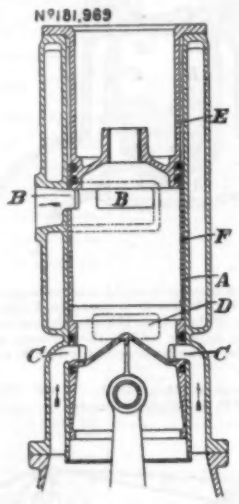
reduce the destructive effect on the surroundings which would be produced if the water were discharged as a solid jet, the inventor imparts a whirling motion to the water by means of the vanes A. The consequence is that the water issues as a hollow cone, which is comparatively harmless.—*June 29th*, 1922.

INTERNAL COMBUSTION ENGINES.

181,969. June 15th, 1921.—TWO-STROKE ENGINES, R. W. Deacon, 70, Titterton-street, Sheffield.

IN this engine the cylinder A has three or more exhaust ports B extending round the upper part of the cylinder wall and discharges the burnt gases into one common chamber, also two transfer ports C placed at 180 deg. round the cylinder at the bottom, and an inlet port D, which admits the charge into the crank case when the piston is at the bottom of its stroke. There is a detachable cylinder head E having an inward projecting sleeve. The piston F has a wedge-shaped head formed by sloping the head upwards at an angle on each side and making a straight line along the diameter of the piston, which deflects the incoming charge upwards. The piston is also provided with a prolonged shell or sleeve fitting over the inward projecting cylinder head

N°181,969

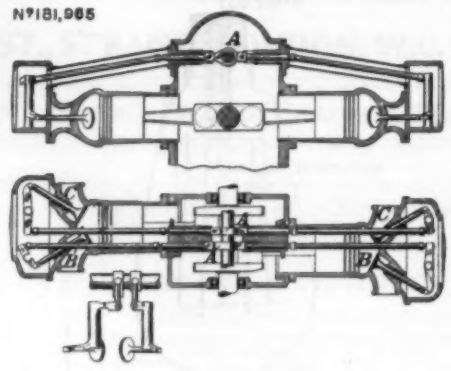


and having ports at the top and bottom, which control the opening and closing of the exhaust and transfer ports in the cylinder. The operation of the engine is as follows. When the piston F is at the bottom of its stroke, as shown, the ports in the piston sleeve coincide with the ports B and C in the cylinder walls, the charge which has been compressed in the crank case rushes in through the transfer ports C and is deflected upwards by the piston head, thus driving out the burnt gases through the exhaust ports B, and continues to drive out these gases during the upward stroke until the piston sleeve closes the exhaust port B in the cylinder walls, the charge then being compressed in the usual way. When the piston is at the top of its stroke the inlet port D is uncovered by the piston skirt and admits a fresh charge to the crank case.—*June 29th*, 1922.

181,965. June 11th, 1921.—VALVE GEAR FOR OPPOSED-CYLINDER ENGINES, Société Anonyme des Anciens Etablissements Hotchkiss et Cie., 6, Route de Gonesse, Denis-sur-Seine, France, and A. H. Wilde, Hotchkiss Works, Gosford-street, Coventry.

In this design of engine practically all the valve gear parts are interchangeable, although the cylinders are offset on opposite sides of the crank shaft. The two cams A A are arranged centrally and operate the valves through tappets and rockers.

N°181,965

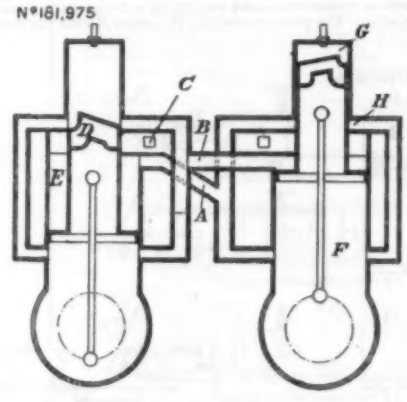


The rockers are of different lengths, but similar proportions of leverage, so that the tappets and push rods may be kept parallel. The inlet valves are shown at B B and the exhausts at C C.—*June 29th*, 1922.

181,975. June 21st, 1921.—TWO-STROKE ENGINE, T. L. Carbone, Kurfurstendamm 29, Berlin.

In this engine an attempt is made to cool the piston by means of air. The diagram represents a two-cylinder engine. The crank case spaces and those above the trunk pistons communicate by means of the passages A and B. Air is sucked in at the open-

N°181,975



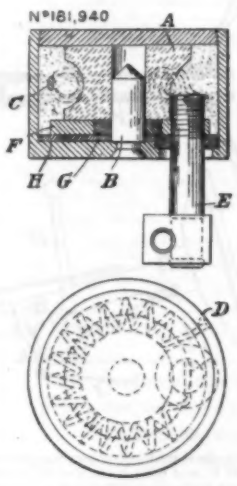
ing C by the combined action of the two pistons, and flows across the passage D in the piston to the annular space E. On the return stroke this air is compressed and escapes from the crank chamber F over the top of the piston G as soon as that piston uncovers the port H. The same sequence of events takes place in the opposite cylinder.—*June 29th*, 1922.

LIGHTING AND HEATING.

181,940. May 25th, 1921.—ELECTRIC HEATING UNITS, *The British Thomson-Houston Company, Limited*, 83, *Cannon-street, London, E.C.* 4.

A cylindrically shaped insulator or core A of lava or other suitable material is supported in a casing by means of a stud B. The insulator has a peripheral groove in which a helical resistance element C is supported. One end of the resistance element extends through the casing at point D, where it is brazed to the casing. The other end of the resistance element is brazed in a

N°181,940



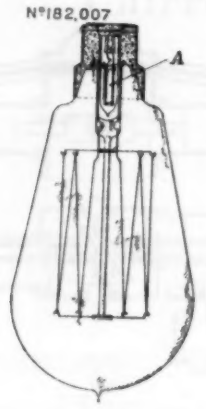
slot in the end of terminal post E. The terminal post is anchored in the casing by means of a metallic disc F, which is insulated from the stud B by the washer G and from the casing by an insulating washer H. After the various parts mentioned above have been assembled, as shown in the drawing, the casing is filled with a granular insulating material, such as magnesium oxide, the cover is put on and the whole unit is subjected to heavy pressure to consolidate it.—*June 29th*, 1922.

182,007. July 25th, 1921.—INCANDESCENT ELECTRIC LAMPS, F. H. Eeles and A. J. Barnett, 80, Bishopsgate, London, E.C. 2.

This lamp is intended for flashing advertising signs and has arranged within the hollow stem used to support the filament a

thermostat A, which is connected in series with the filament. The thermostat intermittently breaks the circuit and produces

N°182,007



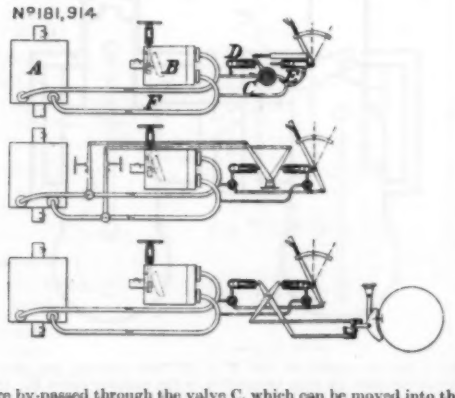
a flashing effect. The idea of the inventors is evidently to make the device self-contained.—*June 29th*, 1922.

TRANSMISSION OF POWER.

181,914. April 29th, 1921.—Variable-speed Hydraulic Transmission Gear, The Variable Speed Gear Company, Limited, and M. K. Ingoldby, Broadway-court, Westminster.

This invention is intended to protect a hydraulic transmission gear against the effects of the motor A acting as a pump, on account of momentum, and producing a dangerous pressure in the system. The pipes connecting the pump B with the motor A

N°181,914

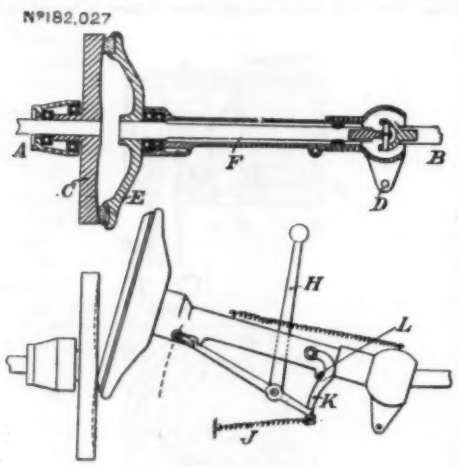


are by-passed through the valve C, which can be moved into the open position by either of the plungers D and E. As shown, the valve is set for forward motion, and if F, which should be the suction pipe is accidentally subjected to pressure, the plunger D moves over the valve C and releases the pressure. For backward movement the valve is set on the opposite side by the hand lever and the plunger E then becomes operative. Elaborations of the idea, as illustrated, are described.—*June 29th*, 1922.

182,027. August 22nd, 1921.—Variable-speed Friction Gearing, C. P. L. van Caubergh, 134, Avenue du Longchamp, Brussels.

In this gear A is the driving shaft and B the driven. The disc C is hollowed out, as shown, with D as the centre of curvature.

N°182,027



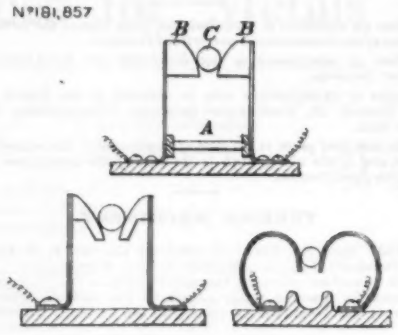
The disc E is furnished with a friction ring curved to the same radius. The shaft F, and with it the disc E, can be swung about D in order to vary the ratio of the gear by means of the hand lever H. A spring J and lever K, by bearing against the pin L, keep the two discs in engagement.—*June 29th*, 1922.

SWITCHGEAR.

181,857. March 30th, 1921.—Circuit Breakers, *E. C. R. Marks*, 57–58, *Lincoln's Inn-fields, London, W.C.* 2.

This circuit breaker depends for its action on the rise of temperature when the current passing exceeds a predetermined limit. When the rod A expands as the temperature rises the contacts B B are removed farther and farther apart from one another, until on a certain temperature being reached they are separated so far that the body C falls down and the current is thus interrupted. As this interruption is effected rapidly and as, moreover, the breaking of the circuit takes place at two contact positions, a practically spark-free interruption of the current

N°181,857

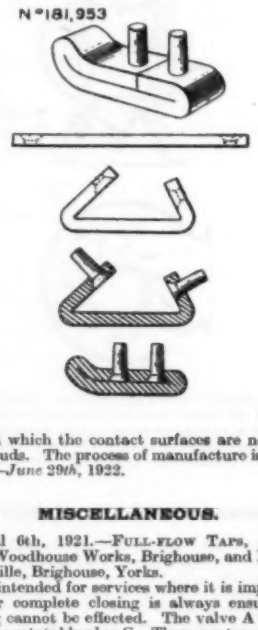


is obtained. Several modifications, such as those illustrated, employing bi-metallic strips are described.—*June 29th*, 1922.

181,953. June 3rd, 1921.—Contact Fingers, *The British Thomson-Houston Company, Limited*, 83, *Cannon-street, London, E.C.* 4.

The object of this invention is to produce a contact finger from

N°181,953



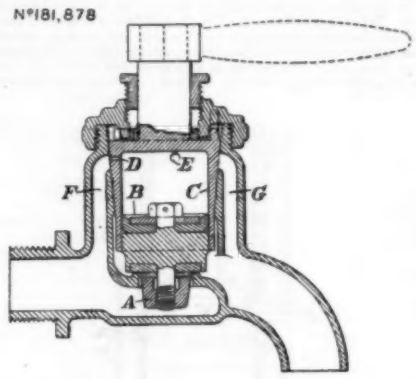
strip copper in which the contact surfaces are not interrupted by the fixing studs. The process of manufacture is obvious from the drawings.—*June 29th*, 1922.

MISCELLANEOUS.

181,878. April 6th, 1921.—Full-flow Taps, R. A. Blakeborough, Woodhouse Works, Brighouse, and F. H. Lawson, Thurstonville, Brighouse, Yorks.

This cock is intended for services where it is important that a full opening or complete closing is always ensured, whilst a partial opening cannot be effected. The valve A is attached to a piston B in the rotatable plug C. There are two ports D and E

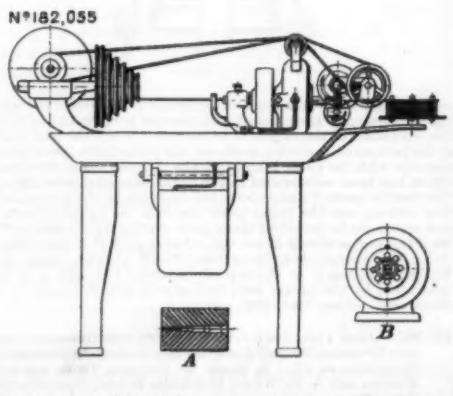
N°181,878



in the plug, which may be brought into communication with the passages F and G. When D is opposite F the water pressure acting on the top of the piston B keeps the valve shut, but when E is brought into register with G the pressure above the piston is released and the valve is opened fully by the water pressure.—*June 29th*, 1922.

182,055. November 21st, 1921.—Wire Drawing, L. G. Breguet and P. A. Breguet, Rue de Carouge 74, Geneva.

N°182,055

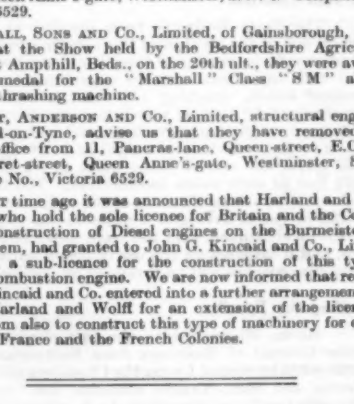


The inventors claim that a greater reduction in the diameter of the stock can be effected at each pass in wire drawing by their process than is possible with the usual system. The specification describes the whole machine employed, which is also illustrated, but the chief interest centres in the dies A. The dies or swaging blocks, it will be noticed, reduce the stock in several stages and are said not to push the stock back in a direction contrary to the feed. The detail B indicates the mechanism used to produce the hammering effect of the dies.—*June 29th*, 1922.

181,903. April 23rd, 1921.—Vacuum Electric Discharge Tubes, *E. C. R. Marks*, 57–58, *Lincoln's Inn-fields, London, W.C.* 2.

In order to protect the bulbs of Röntgen tubes from the disruptive effects of secondary electrons emanating from the anode the inventors deflect these electrons by means of a shield A

N°181,903



made of thin glass or quartz on which a film of tantalum is deposited. This shield deflects the electrons, as shown, towards the metal stem of the anticathode, where they can do no great harm. The two lower views show modifications of the shield.—*June 29th*, 1922.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

SATURDAY, AUGUST 5TH.

North of England Institute of Mining and Mechanical Engineers.—The Institute, Newcastle-upon-Tyne. Annual general meeting. 2 p.m.

TUESDAY TO FRIDAY, SEPTEMBER 5TH TO 8TH.

Iron and Steel Institute.—Autumn meeting at York. For programme see page 96.

WEDNESDAY TO FRIDAY, SEPTEMBER 20TH TO 22ND.

The Institute of Metals.—Swansea. Annual autumn meeting.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

The Weston-Reuter Company, Limited, informs us that its city offices have been removed to 2, Dean Farrar-street, Victoria-street, Westminster, S.W. 1.

The Western Electric Company, Limited, has appointed Messrs. Lionel Robinson and Co. sole selling agents for London, Middlesex and Surrey, for their B.A.G. diffusers.

William Sharp, M.I. Mech. E., asks us to state that he has removed his offices to 11, Carteret-street, Queen Anne's-gate, Westminster, S.W. 1. Telephone No., Victoria 6529.

We are asked by Mr. Charles J. James to state that he is carrying on the drawing-office and printing business of the late Mr. James P. Maginnis at 11, Carteret-street, Queen Anne's-gate, London, S.W. 1.

Guest and Chrimes, Limited, Rotherham, inform us that their secretary, Mr. T. W. Bottoms, has retired, after forty-two years' service with the firm, and has been succeeded by Mr. A. L. Guilmant, chartered secretary.

Alexander Jack and Co., Limited, crane makers, Motherwell, advise us that they have removed their London office from 11, Pancras-lane, Queen-street, E.C. 4, to 11, Carteret-street, Queen Anne's-gate, Westminster, S.W. 1. Telephone No., Victoria 6529.

Marshall, Sons and Co., Limited, of Gainsborough, inform us that at the Show held by the Bedfordshire Agricultural Society at Ampthill, Beds., on the 20th ult., they were awarded a silver medal for the "Marshall" Class "S M" all-steel finishing thrashing machine.

Wright, Anderson and Co., Limited, structural engineers, Gateshead-on-Tyne, advise us that they have removed their London office from 11, Pancras-lane, Queen-street, E.C. 4, to 11, Carteret-street, Queen Anne's-gate, Westminster, S.W. 1. Telephone No., Victoria 6529.

A short time ago it was announced that Harland and Wolff, Limited, who hold the sole licence for Britain and the Colonies for the construction of Diesel engines on the Burmeister and Wain system, had granted to John G. Kincaid and Co., Limited, Greenock, a sub-licence for the construction of this type of internal combustion engine. We are now informed that recently Messrs. Kincaid and Co. entered into a further arrangement with Messrs. Harland and Wolff for an extension of the licence to enable them also to construct this type of machinery for export to Spain, France and the French Colonies.

An Anti-corrosion Association.—In our issue of July 21st we referred in "A Seven-day Journal" to the proposal to form an "Anti-corrosion Association," advanced by Mr. W. R. D. Shaw. We are informed that Mr. Shaw is not, as stated in our note, the secretary of the Institution of Aeronautical Engineers. He ceased to hold that office at the beginning of the year, and was succeeded in it by Mr. L. Howard-Flanders.